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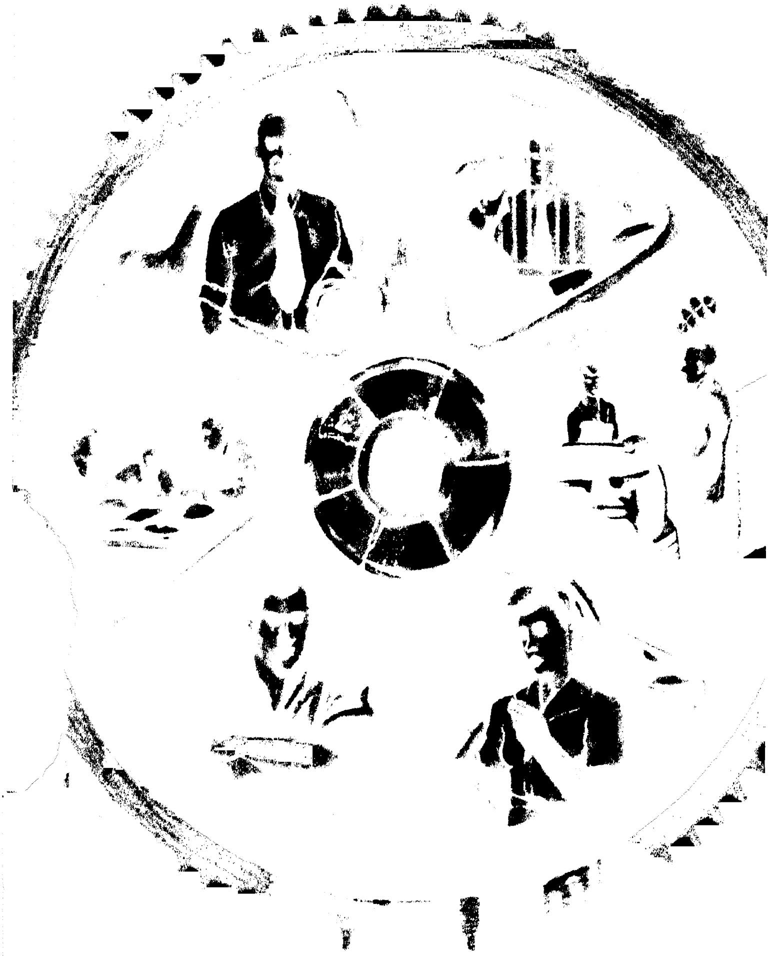

NEW CAREERS IN INDUSTRY

by JOHN M. AMISS *and* ESTHER SHERMAN

Illustrated by SIDNEY W. SEELEY

Whittlesey House
McGRAW-HILL BOOK COMPANY, INC.
New York • • • • • • *London*

NEW CAREERS IN INDUSTRY

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PUBLISHED BY WHITTLESEY HOUSE
A division of the McGraw-Hill Book Company, Inc.

Printed in the United States of America

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A FOREWORD

America's growth has depended largely on individuals—on the man or woman who recognizes a job to be done, a problem to be solved, and is willing to devote the great amount of time and endless patience necessary to achieve this goal.

The youth of today will be our citizens of tomorrow and this group will supply statesmen, scientists, engineers, business and professional men, industrial workers, and farmers. Let us encourage them because they are America's future—and I know it's in good hands.

Vice-president of General Motors; directing head of the General Motors Research Laboratories; president of the Society for the Advancement of Science

THE PROLOGUE

PREFACE

This book is for young people. And for older people who are young in spirit. It tells of opportunity. It tells of great enterprise. It tells of work—of building things.

The over-all tone is one of striving toward ideal aims—a challenge to youth to give and stay with it and grow up with industry and at the same time to fight for progress.

The book is avowedly idealistic. But it is also realistic. It came from men who know.

In the Gray Plan for Postwar Reemployment, Carl Gray, president of the Grenby Manufacturing Company of Plainville, Conn., writes, "Competent professional opinion indicates that one great factor in the occupational maladjustment of American youth has been the lack of occupational information that has been available."

Industrialists and educators talk with graduates of schools and colleges year after year. Counselors and guidance workers help young men and young women to plan ahead. Parents and their sons and daughters debate the future.

And all these people are right when they say that there is too little vocational-guidance truth coming directly out of the plants and the factories.

To deal with such a tremendous subject as careers in industry means both a distilling process and a setting of limits in the ground covered. However, we resolved that whatever we did tackle should be the real story from the grass roots of each field of work and should be checked by a reliable authority in that field. So we went to the GI's of the industrial army as well as to the brass hats. We consorted with both labor and management.

We have thought of careers rather than specific jobs. We did not write of the very necessary unskilled work performed by thousands of people, or even of the assembly line so vital to mass production. Some people start there and build careers, but not many.

We have taken most of the stories and examples of the industrial setup from Detroit and from the automotive industry. And yet we gathered facts and reflections of experience from varieties of industries and varieties of men all the way from Massachusetts to California.

Hundreds of friends have helped to write this book. It seems to us that no one could adequately give thanks to the desperately busy and often war-weary people who have tried to simplify this describing of a huge and complicated enterprise so that young people might learn enough to find for themselves the right starting place and the right way to proceed in order to grow up with American industry.

They have all—but especially the old-timers, men of from twenty to thirty-five years of experience (and we are thinking mainly of that group in the Dodge Plant of Chrysler Corporation)—given of their time and their wisdom because they hope for new leaders to follow them. They quoted frequently, in talking to us, the men they have worked with—John Dodge, Olds and Nash, Durant, Henry Ford, Edison, Steinmetz, Alex Dow, Firestone, Kettering, and Knudsen, as well as Keller, Weckler, vanderZee, Hutchinson, Mitchell, and Zeder. These are great personalities to them. Of course the personality of whom they all spoke with a warmth of appreciation as a great man, a man with a big heart, as well as a real mechanic and a dynamic promoter, is Walter Chrysler.

And they are looking today for new personalities—inventive and creative personalities, and valiant too. For it is the old-timers who believe that industry still needs pioneers—builders of better products and of better ways to live.

But well they know that, whatever the forthcoming economic picture, the only way to build a better world is to build better individuals. So this book is for individuals, those far-sighted enough, generous enough, and adaptable enough to work cooperatively with the men above, below, and beside them.

Pioneers and pilgrims, immigrants, and, in the main, men and women of good faith and good will built America. Their descendants, armed with a strange new tool—industrial know-how—will help to build not only a wealthy, powerful nation, but, God willing, a peaceful, friendly, happy world.

YEARS OF THE MODERN[1]

Years of the modern! Years of the unperformed!
Your horizon rises, I see it parting away for more august dramas,
I see not America only, not only Liberty's nation but other nations preparing.

I see . . . the solidarity of races,
I see that force advancing with irresistible power on the world's stage.
(Have the old forces, the old wars played their parts? Are the parts suitable to them closed?)

Never were such sharp questions asked as this day,
Never was average man, his soul, more energetic, more like a God.
His daring foot is on land and sea everywhere.

With the world-spreading factories he interlinks all geography, all lands,
Are all nations communing? Is there going to be but one heart to the globe?

The earth, restive, confronts a new era

Unborn deeds, things soon to be

Your dreams, O years, how they penetrate through me!
The performed America and Europe grow dim
The unperformed advance, advance upon me.

WALT WHITMAN.

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[1] Taken from Whitman, Walt, "Leaves of Grass," 1891, Doubleday, Doran & Company, New York, with courteous permission of the publisher.

THE BEGINNING

If you scan this book and take from it that which is good for you; if you collect from it both facts and ideas as though you were gathering the best thoughts out of the best brains of the men of industry, and if the ideas serve you; and you, even you alone, profit thereby, the purpose in the writing has been served. You may skip this beginning, saying to yourself, "That's old stuff. All these introductions to vocational books read the same: 'Opportunity knocks, young man. A great career is yours if you will do as John D. Blankety-Blank did—get up early and do the chores, save your dimes and study at night.' Old stuff!

"A fellow has got to be wise to himself these days and know where he's headed and whether he's got what it takes to get there. They've got tests he can take—like the Army and Navy use—and they help to give you a slant about yourself, tell you what you might do best. Then, if you know what you've got on the ball and you know where you want to get, it's up to you to find out what it takes to get there.

"Now a book like this, somewhere in it, ought to tell you where you can head with a big outfit like Chrysler, General Electric, DuPont, Ford, Lockheed, or General Motors, and what they expect you to know, and how you go to work to get the first start. Then it ought to tell you what the heck there is in the future for a chap who picks the right course according to what he knows he's got in him to give, and then stays with it and kind of grows up along with each job he gets, until at last, long last perhaps, he's built himself a career—a good career, I mean, something a man can be proud of."

If you say just that to yourself, you will have put in a crude but forthright fashion the essence of what we intend to give you in this section: The Beginning.

We begin with the definition of the terms we use:

JOB (from Jobbe, a portion, lump)—A piece of work; anything to be done, as, a mechanic has many small jobs on hand.

CAREER (from Latin, *carrus*, wagon)—The general course of experience or conduct in life; in particular, a professional or public course in life.

These definitions speak for themselves to show you the specific significance of a job or a piece of work and the broad vision of that course of life which is to a man as the full story of his public life by which his deeds may be known. We wonder if Emerson had in mind the Latin word *carrus*, or wagon, from which our word "career" has come when he wrote, "Hitch your wagon to a star."

This entire book deals from now on with definite pictures of the demands and the specific characteristics of the kinds of jobs and careers that are open to you in American industry ("where you can head and what they expect you to know"). However, you will find toward the end a chapter called "Make Up Your Own Mind" which deals rather fully with the problem of self-appraisal and intelligent choice ("being wise to himself and knowing where he's headed").

You should first, of course, as far as you can, know yourself; then you should know the possibilities for a person like you; and then you and you alone must make your choice. Having chosen the general field of work, such as engineering, personnel, skilled crafts, production, sales, time study, industrial education, accounting, or whatever line you expect to take, you can pick out the point at which you are qualified to begin. You can also map out your further training. You should then present the plan you have, the particular job you at present seek, and the background which proves you are ready for that job, to either the department of industrial education (if you need training in the apprentice school or in some special industrial training program) or the department of personnel of the particular company for which you wish to work. If possible, present your plan in person; in a letter if a personal interview is not practical. In either case put your best foot forward, as first impressions are of great significance.

If you are applying for work in a big corporation, some one of the responsible representatives with whom you talk will be the one to tell you of the conceivable future for you if you are able to make good. If you apply to a smaller organization, probably one of the company executives will counsel you.

Let us suppose that you are accepted as an apprentice in a training program or as a probationary employee. Then you can do no better than to recall your own words of which we now remind you. You are, we will say, "a chap who has picked the right course according to what he knows he's got in him to give." Note that you said *give*, not get. And then you said, "This man *stays with it* and kind of *grows up* along with each job he gets, until, at long last, he's built himself a career."

These plans are excellent. You can't beat them. But they'll be hard to follow. You'll find many scoffers and defeatists in industry. They'll tell you there's no use in trying. They'll tell you it's only pull that counts. They'll tell you that industry wants men who are like cogs in the big machine of organization, who will be yes men, keep their mouths shut, think only as the boss thinks, and never stick their necks out.

They'll tell you the boss will keep down a man who is too good because he's afraid of his own job.

They'll tell you not to work too hard or you'll kill the job. People will bother you. Red tape will bother you. Dogmatic thinking and superconservatism will bother you. You'll have many hurdles to clear, some of them high; very high they'll seem at the time. But if you stick to your course and if you keep your stride, you'll get there—to whatever spot, whatever goal, you know is right for you.

We urge but one thing: aim high, "hitch your wagon to a star." And we end this section—The Beginning—with the words of a man who died, much honored, at ninety-three, leaving all his property to the United States, as he had given his life in the service of its people. He had always tried to *give*. He had toiled through long years at hard jobs and always *stayed with it*. And at the end he had become one of the most *grown-up* men who ever lived.

This is what Justice Oliver Wendell Holmes had to say about a man's career: "Whether a man accepts from fortune her spade and will look downward and dig, or from aspiration her axe and cord and will scale the ice, the one and only success which it is his to command is to bring to his work a mighty heart."

INDUSTRY

Industry began when an unknown man invented the wheel.
The God of all the spheres endowed man with brains and physical strength.
The needs of his time and setting drove him, in human toil, to find safer and then easier ways to live.
He began to reason and he grew in mind and power over nature.
He discovered, without words for it, the law of leverage.
And he manufactured, from a rock and a limb, the first lever.
He developed skill and ingenuity in its use. He improved the lever.
But as yet industry had not been born.

It took an extra gift from God, a talent called imagination.
When some unknown man found himself possessed with this driving, creative urge to visualize and dream and experiment, he kept at it, in toil and thought and strain, until he had conceived a wheel.
As he rested he looked on his work. It was good and he was pleased.
For he had devised tools to build a machine.
And it was then that industry was born.

Industry is the systematizing of human toil, based on human need, perfected by skill, ingenuity, and persistence, and given the seeds of life through human dreams.
Thus it springs from art as well as science and is fostered through education.

INDUSTRY

But—as wise men long have seen and told—

Industry, mammoth, Gargantuan creation of man in his conquest over matter, can be a machine that devours its master.
It can possess him until it comes to be the love of money and the root of monopoly and greed.

And then man, for whose sake it was created, shall fear it.
And fear shall drive him to fight it.
For his very soul shall rise up against it.

From such stupidity as this,
From the threat of perversion of man's very own tools, without which he is helpless in a world of natural laws and forces,
Shall come the growth of new and higher ideals.

The men of the age just passing who toiled and persisted and gave of themselves that industry might grow, that mass production might come into being, were pioneers with the high aims of pioneers to advance mankind.

And in this hour new leaders—new creators with high purpose and with a spiritual vision—shall rededicate industry, in accordance with the needs of today, to the service of a world of men who shall walk in friendship, in tolerance, and in understanding.

THE MEN OF INDUSTRY

I. *Men Who Direct*

Men Who Conceive the Major Ideals, Ideas, Plans, and Policies for the Entire Corporation. Men Who Originate the Over-all Strategy and Inspire through Keymen Its Functioning.

Board of Directors, President, Vice-presidents, Top Management.

II. *Men Who Manage*

Men Who Carry Out the General Plans and Policies.

Executives, General Managers, Plant Managers, Supervisors, Junior Executives.

III. *Controllers of Money Affairs*

Men Who Carry Out Financial Policies.

Controllers, Auditors, Budget Men, Accountants.

IV. *Legal Interpreters*

Men Who Interpret Industrial Law.

Company Lawyers, Patent Attorneys.

V. *Creators*

Men Who Dream, Design, Experiment, and Engineer New Products.

Engineers, Research Men, Designers, Draftsmen, Technicians, Chemists, Laboratory Men.

THE MEN OF INDUSTRY

VI. *Planners*

Men Who Think Out Plans, Develop Methods, and Adapt Designs into Concrete Directions.

Purchasing Men, Planning Men, Master Mechanics, Time-study Men.

VII. *Leaders in Production*

Men Who, through Other Men, Transpose Directions into Results; Men Who Translate Thought into Action.

Superintendents, General Foremen, Foremen, Assistant Foremen.

VIII. *Doers in Production*

Men Who Are Builders and Artisans; Men Who Produce Parts and Assemble Finished Products.

Patternmakers, Toolmakers, Diemakers, Machine Rebuilders and Machine Repairmen, Machinists, Job Setters, Machine Operators, Assembly Men, Foundry and Forge Men, and Scores of Others.

IX. *Inspectors of Production*

Men Who Evaluate, Test and Control Quality of Products.

Inspectors in Production, Layout Men, Testers.

X. *Sellers of Products*

Men Who Promote Sales, Distribute and Service Products.

Advertising Men, Export Men, Sales Executives, Distributors, Regional Managers, Service Men.

XI. *Specialists*

Men Who Are Trained in Special Fields and Who Meet Special Needs in Industry.

Doctors, Nurses, Dietitians, Commercial Artists, Statisticians, Secretaries, Plant-protection Men, and a Host of Others.

XII. *Maintainers of The Plant*

Men Who Lay Out, Set Up, Conserve, and Rebuild the Plant Facilities.

Plant Engineers, Millwrights, Electricians, Steam Fitters, Plumbers, Carpenters, and All Maintenance Men.

XIII. *Men Who Work in Human Relations*

Men Who Select, Guide and Conserve the Well-being of Employees.

Personnel Men, Medical Men, Safety Men.

Men Who Build Good Will, Harmony, and Better Conditions for Work.

Labor-relations Men, Public-relations Men.

Men Who Teach, Develop, and Inspire Men to Better Thinking and to Better Doing.

Industrial-education Men.

THE FOUNDRY AND THE FORGE

THE FOUNDRY

INDUSTRY begins in the earth itself. From deep in the ground men bring forth raw materials, and the men who are miners are the first workers of the industrial process. However, we are thinking and writing about American industry in so far as it concerns the possible careers for those men who make and sell products useful to society. This involves mass production, or the making and assembling of identical interchangeable parts into finished products and the shipping and selling of those products. It also involves the care and control of the thousands of people and equipment necessary to such a tremendous enterprise.

It is obvious that we can give you only the high lights of the over-all picture. In the process of selection we have concluded that under present conditions the jobs being carried on by foundrymen do not lend themselves to presentation as possible careers.

Supervision in the foundry offers excellent, fascinating, and even absorbing possibilities for a man's career. Managers of foundries, who know the vital character of the part they play, are so steeped in the drama, the variety, and the challenge of their work that the roaring and the screeching, the blistering heat and the grime and dust, are like the natural setting for a working life they themselves vow they never want to leave.

The foundry is responsible for making castings. As you read on in this book you will find written up among the careers of the artisans, or skilled tradesmen, that of patternmaker. And although we are not picturing for you the foundry—that most colorful and exciting of plant settings, where huge cranes travel fast and furnaces roar, where giant magnets lift pig iron, bales of steel, and coke, all of which are then dumped from great swinging buckets on electric trucks to feed the cupolas out of which flames (blue, green, red, yellow, purple, and every shade thereof) leap and dance—we hope you will consider well our coming statement regarding patternmakers: it is also necessary, in order to be thoroughly intelligent in this highly specialized field, that a man have knowledge of and contact with the foundry; and actual experience there is best of all.

Such a place of hot and seething chemical changes in metal is not an easy place to work and to learn. But if you want to know industry in the raw and from the ground up, you couldn't make a better start for, let us say, a top management career than in the foundry.

THE FORGE

If you have ever seen, in this day and age, the kind of forge and blacksmith shop that Longfellow pictured when he wrote: "The smith a mighty man is he, with large and sinewy hands, And the muscles of his brawny arms are strong as iron bands," you may have a false notion of the men and their activities in the forge division of industry.

In the forge plant, steel, or whatever metal is to be shaped, is brought to a red-hot heat in a furnace much as the smith's horseshoes or wagon tires were heated, but no mighty man swings his hammer and pounds the great bar of steel into the shape of some industrial product possessing great strength and resistance: for example, a crankshaft. Instead, the operator of the furnace—he is called a heater—lifts the bar with a pair of 6-foot tongs which hang from a swinging hoist and steers it into position on a die, set in a huge machine called a steam hammer; whereupon the hammerman takes over. And if it happens to be a crankshaft he is forging, he'll use a hammer that exerts 12,000 pounds of pressure when gravity is the only force concerned. But the extent of the blow from that hammer is many times multiplied when the power of steam is put behind its fall.

The regulating of the steam pressure that controls the blows of the hammer is done by a foot pedal. So "the muscles of his brawny arms" are no part of the smith or hammerman of today's industrial forge. His skill is in the control of that gigantic sliding block known as a ram—the vital, dynamic part of the hammer—by means of his foot on the pedal. And he may lower that block or ram, which holds the upper die, so gently that it could strike the lightest of blows; or he can bring it down with such a resounding crash that the steel is flattened like a pancake, the sound is like that of a shot from a cannon, and the building shakes as from an earthquake.

Imagine many such hammers, some gently denting a block of steel and others pounding in a deafening crescendo like a cannon, and you can picture the activity of the forge.

In some industrial plants hammermen act also as die setters —a skill acquired through long experience—and they are a valuable part of the whole group of men in the forge.

However, it seems to us that the work in the forge, like the work in the foundry, which may be considered in the light of a career is in supervision.

And the background desirable for such a career is a practical working knowledge of die design, die sinking, forging, and metallurgy of metals. To obtain this background, where experience in the forge plant itself is essential, the type of training and education found in a college cooperative course lends itself best to the particular need.[1]

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[1] See chapter on "The Schools and Industry," pp. 204-213.

As with the foundry, to learn about the forge plant by working in it cannot fail to help that ambitious young neophyte in industry who has his eye on the upper part of the ladder but knows enough to plant his feet on the lowest rounds.

MACHINE OPERATOR

IF YOU must start your career in industry as one of those thousands of men labeled as production labor, there are many compensations that will be yours. You will have the satisfaction of knowing, every single step of the way, that it is up to you. And what you can learn for yourself with extra effort and labor, night school, study at home, extra attention to your job, will be hard-won advancement for you.

But if you can lift yourself by your bootstraps and be that rare specimen of a man—the one who rises above his fellow workers through sheer worth and ability and perseverance to teach himself, you will have great reason to be proud. You can look back at the hurdles you had to take and remember how high they seemed, each in its turn, and how often you wanted to balk or refuse the jump like a nervous, frightened, untrained horse. You can remember how you made yourself go straight at the barrier and through sheer will power go over it. You will be able to see, as you look back over your career, how, little by little, you were growing up. And there's nothing more to be desired in this life than to keep on growing up until the last hour of your last day on this earth.

If you start as a machine operator, you are classed as semi-skilled labor and you are somewhere near the lowest rung of the production ladder. You may be sure that the business of meeting production, with all its carefully planned detail, its need for the coolest head and the stoutest heart by any man at any helm, no matter how small the craft he is piloting, is the most challenging job of all industry. That is a broad statement. However, the handling of the human-relations *need right now—right down* on the firing line—is the most critical need in today's industrial democracy. *If you move on from* machine operator a step upward to meet the test of being a good straw boss or group leader; if you can handle men and handle the responsibility of getting out your schedules; if you can be called a "right guy" by your followers and a good man by your superiors, you are on the way to growing up. All you need to do is to stay with it.

And whatever new jobs—sometimes hard jobs to lick, sometimes painfully "hot" jobs—whatever well-nigh impossible schedules come your way, with each one in turn you must, as a golfer would put it, keep your eye on the ball and follow through. You must stress quality, quantity, and harmony. There is no royal road to production. And from you as a machine hand, up to the president in charge of everyone in the plant, the thing that keeps the wheels turning, meets competition, and produces the goods for all of us to use is the "everlastin' teamwork of every bloomin' soul."

The picture of the man who is determined to use each job he is given as a steppingstone to a more demanding and more responsible opportunity is a true picture for some of you who read this book. It is, however, only a part of the total picture. There are going to be young men—and young women too—who know within themselves that they are like the privates in the infantry. They know that wars cannot be won without the privates—a lot of privates. They are the people who chuckle as they hear that God must especially love the common man for he made so many of him.

Let the bound-to-rise fellows sit up over technical books, go to night classes in mathematics, ask questions and keep digging at the why of all the machinery around them, volunteer to help the machine-repairman, and just fight their way up from the ranks. Let them do it and more power to them, say these other people. "But as for me, well, we're not all cast in the same mould. I don't want the grief of being a foreman. I know this job. I like it. I know my machine like a brother. Somebody has to run the machines. I'm safe here. What's five cents more an hour to run that job in heavy oil? I don't want it. Money isn't everything. Sure, I'd like to go to some night class, but not to dig up more grief about factory work. What I do is to get books, right now, about roses. A man only lives once. Me, I may never set the river on fire but, believe me, I can grow roses. Me want to be a foreman? Look at how fast John's hair turned after they made him foreman. Not me. He'll build a bigger house than mine. He'll eat richer food. He'll wear richer clothes. But me, I'm rich too —I'm rich in living. I grow roses."

MACHINE OPERATOR

I. Duties

- A. Develop skill in operating one particular machine which is being used for production of similar parts. For example, a punch press, any kind of drill press, a stamping machine, any kind of milling machine, any size of screw machine, any lathe, a line borer, a gear cutter, a grinder, or any other production machine.
- B. Obtain sufficient knowledge of the machine to be sure it is kept clean, safe, and lubricated. In short, give constant care to your own machine.
- C. Obtain knowledge of all tools and equipment such as gauges, drills, or cutting tools to enable you to keep them in proper condition to do the particular job you have at hand.
- D. Meet whatever production schedule is assigned. If working on an hourly basis, keep up production of parts for a full day or shift.

II. Working conditions

Inside work. Noisy. Slight hazard from flying particles of metal. Occasionally workers incur dermatitis from working in oil. State safety inspectors make periodic inspections.

III. Wages

Hourly basis. Vary from 75 cents to $1.25 or more, depending on skill, experience, and section of the country.

IV. Qualifications

A. Education: At least eighth grade or equivalent desirable.

B. Training: Depends on job classification, *i.e.*, the kind of machine the trainee is to operate. Varies from few days to six months.

C. Experience: Varies with job and machine. On a simple drilling operation, the worker is called experienced after a few months' work. Skill improves continuously in most cases as the worker becomes more and more familiar with the machine and the job.

D. Physical: Good health; good sense of rhythm; good eyesight; ability to stand on feet eight hours; energy; stamina.

E. Aptitudes: Mechanical ability; ability to do precise and accurate work. Applicants in some plants must pass tests on general intelligence as well as above.

F. Personal: Interest in doing one specific job well. Patience. Steadiness. Ability to accept orders readily and cheerfully. Ability to fit into a group in the give-and-take of a shop atmosphere, *i.e.*, be ready to like others and neither be touchy nor hold a grudge. Pride in fully knowing your job, your machine, and increasing your skill. Satisfaction in smooth, steady, rhythmic performance.

JOB SETTER

CAN he set up his own job?"

The employment office has just called a foreman. They tell him they can fill his requisition for a Warner Swasey screw-machine operator; they have a man with five years' experience who's passed his physical examination—he's "through the hospital," they say and shall they send him up.

Now if that foreman is short of real job setters, he'll very likely answer, "Can he set up his own job?" And if the answer is yes, the man is hired—at least, he becomes a probationary employee, in a big corporation. It's a distinct asset to be able to set up your own job; but, just as the skilled operator of one machine is not an expert machinist, it is also true that having learned to set up your own special job is a long way from being a job setter.

Some years ago we talked with a man who was an inspector on production in a part of a war plant where the cylinder block of a Rolls Royce motor for airplanes was going down the line, being machined from the start—that is, from the aluminum casting. It was a mighty busy place and a holdup on one job meant that the line from then on was "down." The inspector told us that there was a fellow there named Herman who was the one man in the whole department most in demand. He was the job setter. When he got through adjusting the setup on one machine, he had to grab up his kit of tools and move at a fast lope to the next most important job where his expert touch was needed. Poor Herman! He never really had time to stand up straight; he was either bent over some machine or bent forward in his loping trot, with his little kit in one hand and waving off some importunate machine operator with the other: "I gotta take Jake next; keep your shirt on, Bud, I've only got one pair of hands." Sometimes he sounded a little badgered by the very volume of the bellow, "Herman! Herman!" that rose up from two directions at once. But in the main, and mark this well, old Herman, who had been performing as a job setter for fifteen years and now had a lot of "hot" jobs essential to our war effort to keep running, was about the most contented, pleased-with-his-world-and-himself-in-that-world industrial employee the inspector had ever met.

Those cylinder blocks were big; and the beauty and the wonder of the job being done on them lay in the fact that so many machining operations by "automatics" of modern type were hustling them along toward the air over Europe while—in spite of the rush—they held with every single dimension to amazingly fine tolerances. But the man who had the skill behind that accurate setup—the properly ground tools, that exactly right turn of a screw here, an adjustment there, which assured the holding to the limits, the "passing" of each block by company and government inspectors—was Herman. As the foreman used to say, if Herman ever missed a day they'd all be lost; no hay-hand job setter could do that job. But Herman never missed a day. He was doing "a swell job"—they all said so. He was useful, and he was happy.

JOB SETTER

I. DUTIES

  A. Read blueprints and operations sheets.
  B. Know how to operate all the machines in one department of a plant.
  C. Set up any machine in his department for the particular

job assigned by the foreman. Short schedules (a limited production run of a part) will mean frequent and varied setups for the same machine.

D. To whatever extent is required in his department, know how to set feeds and speeds, considering metals to be used. Know dimensions and uses of standard bolts, threads, screws, keys, and tapers. Grind tools, considering proper clearances. Use and check gauges.

II. WORKING CONDITIONS

Inside work. The particular conditions will depend on department in which he works. In general, noisy. Same safety hazards as those for a machinist.

III. WAGES

Hourly basis. In certain companies a job setter always earns 15 per cent more than the group average of his own group of operators. His wages may vary from approximately 60 cents—with 5-cent increases at six-month intervals—when he is learning in the apprentice school, up to $1.40 or more per hour, depending on the section of the country and individual company policy.

IV. QUALIFICATIONS

A. Education: Twelfth grade desirable. In school preparation put emphasis on mathematics and science. A more limited school background will be a handicap if the job setter wishes to progress into the skilled trades or engineering fields in industry.

B. Training: Two to four years of apprentice training is desirable, inasmuch as later progress toward production supervision will be aided by a broader training foundation. Training in the apprentice school, with a minimum of 4,000 hours, including shop theory, blueprint reading, shop mathematics (algebra, geometry, trigonometry), is desirable. The trainee who has been graduated from the school should become a more expert and all-round job setter than the one who has merely learned his own particular department job.

In the latter situation he may start as a machine operator, become a "utility man," and more or less pick up his knowledge from experience in one situation.

C. Experience: Before acceptance as an expert all-round job setter, at least another year, possibly two years, of varied shop experience is necessary.

D. Physical: Good health. Good eyesight. Stamina. Ability to stand on feet eight hours. Energy.

E. Aptitudes: Mechanical ability. "Feel" for machinery and tools. Spatial judgment. Ability to concentrate.

F. Personal: Interest and liking for tools and machines. Intelligence in adapting knowledge and fundamental principles of procedure to various situations and problems. Patience. Ability to cooperate and have good working relationship with a group of varying personalities.

MACHINIST

SO YOU want to be a machinist. Then you're in for a strenuous career. You must really be able to "take it." A machinist is not a white-collar man, and he's very far indeed from a hod carrier or a human robot. Some men feel that there's a close alliance between the ability that a surgeon has and the know-how of a real machinist. "A good pair of hands—whatever his bedside manner may be—is what I want when they cut into me." It was a famous surgeon who said that. He went on to tell that sometimes the most brilliant of his colleagues must refer again to Gray's Anatomy before certain operations. It's like a navigator who still needs Nathaniel Bowditch. The most learned of writers still turns to his dictionary. And if you ever become a machinist, you'll know the need of your Machinist's Handbook.

To do a job you can find the information in a book, but you must find the skill in yourself. However, it isn't enough to have a good pair of hands. You will need knowledge of machines. You must have experience. Usually it will take four years of apprentice training after high school is finished to make a machinist out of you. An operator of machines may have all the speed and sureness in the world on his one machine; his production may be high, his wages may be good, his career may be the happiest and most successful to be thought of for him; but he's not a machinist. It is possible to train production workers in a few weeks or, at the most, months. It takes years to grow into a machinist.

MACHINIST

A machinist understands as well as manipulates his machine. He controls its work. He knows how to set up a job. He starts with the blueprint from the engineering division; he reads that; he consults the operation sheets from the master-mechanics division; he interprets them; he goes after the proper tools, fixtures, and gauges; he grinds the tools; he adjusts all his equipment; he tests the machine performance. In a word, he is in control; he is responsible; let anything go wrong and he must fix it. And this he does with not one but with many machines.

So you want to be a machinist! Then prepare to use your head and your hands and your heart. For you must study from books and from teachers, and work many paper problems; you must bend your back to a heavy task and feel with the tips of your fingers the life in both metal and machines. And you must have the heart to work in grease and grime and oil and dirt and noise and confusion, to work at monotonous, repetitive, never-ending drudgery, and then to rise almost to the heights of creative genius, and "lick a tough job." And when you've once done that, and perhaps a real old-timer spits out his tobacco juice, looks at you appraisingly and says, "Might make a shopman out of you, after all," then you'll be on your way, and no one will be fool enough to tell you what it is to be a machinist—you'll know.

MACHINIST

I. Duties
  A. Read blueprints and operations sheets.
  B. Set up, operate, and repair an engine lathe, turret lathe, drill press, milling machine, thread miller, grinder, planer, shaper, screw machine, and gear cutter.
  C. Know how to turn and form metal, including boring, reaming, drilling, tapping, milling, planing, and shaping.
  D. Grind tools; use and check gauges; know dimensions and

uses of standard bolts, threads, screws, keys, and tapers; set feeds and speeds.

II. WORKING CONDITIONS

Inside work. Noisy. Slight hazard from flying particles of metal. Occasional workers incur dermatitis from working in oil. State inspectors of safety make periodic inspection.

III. WAGES

Hourly basis. Vary from apprentice starting rate (for training in apprentice school) of 60 cents to $1.75 or more, depending on skill, classification, and section of the country.

IV. QUALIFICATIONS

A. Education:—Essential: At least twelfth grade or equivalent. A more limited school background is acceptable only in exceptional cases where both tests and a trial period of training show unusually high mechanical aptitude, ability to learn, great drive to succeed, and an excellent character. (Cooperative plan after two years of high school possible.)

B. Training: A minimum of two years of apprentice training. Four thousand hours in the apprentice school, including shop theory, blueprint reading, shop mathematics (algebra, geometry, trigonometry).

Technical knowledge of all machine-shop metals, machinery and equipment and of shop processes is part of shop theory.

C. Experience: Before acceptance as an expert, all-round machinist at least another four thousand hours of varied shop experience in the plant must be added to the qualifications.

D. Physical: Good health. Good eyesight. Stamina. Ability to stand on feet eight hours. Energy.

E. Aptitudes: Definite mechanical ability. "Feel" for machinery and tools. Ability to do accurate precise work. Ability in mathematics. Ability to reason and concentrate. Applicant must pass varying tests to determine these aptitudes.

F. Personal: A very real interest in machines and interest in craftsmanship. The will to work, the will to learn, plus a high degree of native intelligence to insure practical application of knowledge to changing situations and problems. A dynamic but emotionally balanced personality well charged with honesty, loyalty, and cooperation.

TOOLS

But on the whole . . . man is a tool-using animal. Weak in himself and of small stature, he stands on a basis, at most for the flattest-soled, of some half-square foot, insecurely enough; has to straddle out his legs, lest the very wind supplant him, feeblest of bipeds! Three quintals are a crushing load for him, the steer of the meadow tosses him aloft, like a waste rag. Nevertheless, he can use tools, can devise tools; with these the granite mountain melts into light dust before him; he kneads glowing iron as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing, with tools he is all.

—Thomas Carlyle, "Sartor Resartus."

TOOLMAKER

WHAT was all this talk around the country about finding tool and diemakers and machinists and machine builders right after Pearl Harbor? We were in a hurry then, I know. We needed tools, I know that; you can't make airplanes in a big way without fixing up the machines to turn them out, and that also means special fixtures for holding and tools for cutting and gauges for measuring all the thousands of parts that have to be milled and drilled and a dozen other things; and I know it means dies for wings and big parts that they stamp out.

"But they had plenty of men in the factories back then; they could have taught them how to make tools and dies. Why didn't they just promote a lot of fellows who ran machines and wanted better paying jobs, men over draft age who'd been with the company a long time; I think those fellows deserved a break. I never could see why they combed the country and got a lot of ignorant old 'foreigners' that maybe had a little farm they'd retired to and didn't want to go back to hard work; but those industrial giants, as they call them, were howling around that just these little old tool and diemakers had to be found or the big giants couldn't get the ball rolling—I mean they really acted as though we couldn't win the war without just tool and diemakers."

Well, my "upstart" young friend, who keeps on most brashly battering us down to that one particular spot of good real earth where your own feet are planted, and calls (with no mean lungs from a generation we thought "soft"!) for the real "dope" about jobs and careers in industry, we'll answer you.

You grant that "conversion," as we all speak of the period when we prepared to consistently turn out a steady flow of war materials, demanded skilled tool and diemakers. You also grant that we were in a hurry; Japanese from the Aleutians and Germans from the Argentine were no empty threat, as we have now learned. But in suggesting that we quickly develop machine operators into toolmen and diemen you fail completely to realize how long it takes to develop any of the highly skilled artisans in industry—patternmakers, toolmakers, or diemakers. It was for their long years of splendid training, very often in Germany, Sweden, England, or Scotland, plus their actual years of experience in their younger days, that the retired but far from ignorant "foreigners" were called back from their farms. And the very fact that the greatest leaders of industry knew that without these skilled artisans the backbone of their business was gone and the whole body would slump—this very fact proves that they, the leaders, properly evaluate those stalwart non-commissioned officers in their army; and it proves that they, the leaders, are in turn worthy to be called great generals, or, as you called them, industrial giants.

If you wish to know more about this particular brand of artisan called a toolmaker, you may well review what is needed to make an expert machinist and make that your foundation. Among a group of mechanics where toolmakers, diemakers, machinists, and patternmakers are all indulging in a bit of friendly ribbing, mixed with good-humored debate, about the traits peculiar to the workers in each trade, you will find every man honestly admiring of his fellow artisans, for these men in the skilled trades have tremendous loyalty to all craftsmen. However, in their very expressions you will find a cue to certain traits peculiarly desirable for each trade. For example, if a machinist is attempting to tease a toolmaker (by the way, that's a hard thing to do, for a toolmaker has a look about him like the Rock of Gibraltar and "rises" just about as easily), the first thing he may say is, "Nothing to being a toolmaker, be one myself if I was slow enough. I don't know, though; you got to be pretty finicky to fuss over some little gadget and nurse it along like those guys do."

Well, a toolmaker *is* finicky; he *must* be finicky; for he is a careful, accurate, precise worker. Remember that he makes from detailed blueprints such essential equipment as jigs, fixtures, cutting tools, and gauges. Above all else he must be a perfectionist and to be that he must have the patience of Job. We saw a toolmaker one day bending over his work on a speed gauge to be used on bomber parts; the gauge costs several thousand dollars to make; the man's spectacles had slipped down his nose, every movement of his hand or body was so deliberate it was nerve-racking (to a high-strung, nervous person), but he was brooding and almost clucking over that unfinished gauge, in the midst of all his orderly array of working tools, as happy and as protective as an old mother hen; he didn't see that we and the foreman were watching him; complete absorption, getting out of one's self into useful, soul-satisfying labor, that is what he had; and that is no small reward for a man. A good toolmaker, a "real" toolmaker, they call it in the shop, at work on a fixture that has five hundred detail blueprints (for that is possible) somehow represents to us what some of the educators have clung to as the aim of all education—"integration of personality for social efficiency." But if you ask a real toolmaker if he likes his job he'll probably say, "Oh, sure." And after a long pause while you both just stand there he may smile a little and add, "I like it." Toolmakers get plenty of exercise for their brains and their hands but they don't tire out their tongues.

If you are going to be a real toolmaker, not just get to

be good enough to work somewhere in a toolroom, but get to be a toolmaker who is noted around the plant, you'll find you acquire many traits such as honesty and thoroughness in your work, persistence at a difficult problem, loyalty to a high standard, concentration for detail but also imagination to plan ahead and improve ways and means of doing a job, poise and balance and the will to carry on; many traits such as these which can, and sometimes will, carry you far indeed up the industrial ladder. But if you don't climb on and on up that ladder and if your whole career is the career of a toolmaker—provided you're a real toolmaker—we know full well that if someone says to you, "How do you like your job?" you'll hesitate and then you'll smile and then you won't tell all that it means to you, but you'll answer, "I like it."

TOOLMAKER

I. Duties

- A. Read blueprints of fixtures, jigs, special cutting tools and precision gauges sent to him by the tool engineer.
- B. Devise and plan out ways of engineering the particular tool, fixture, or gauge to be constructed.
- C. Holding to measurements (that must not vary from the specifications by one-thirtieth of a hairbreadth), "build" by both machining and hand work whatever jig, fixture, tool, or gauge he is called upon to build.

II. Working conditions

Inside work in a special toolroom which is generally quieter than the usual shop or production department. There is an unhurried feeling quite different from the pressure of a production department, but everyone seems busy and intent on his own problem. Safe and sanitary—there is the slight hazard from flying particles of metal which any machinist will experience.

III. WAGES

Hourly basis. Vary from apprentice starting rate (for training in the apprentice school of 60 cents, with 5-cent increases at six-month intervals) up to $1.75 or more, depending on skill, merit, ability, and section of the country.

IV. QUALIFICATIONS

A. Education—Essential: At least twelfth grade or equivalent. In school preparation, put emphasis on mathematics, physics, chemistry, and mechanical drawing. A more limited school background is acceptable only in rare cases; for example, where the applicant has been trained in one of the high-standard European trade schools where, often, five hours of every day are given to academic studies and the following seven hours are spent in getting shop training.

B. Training: Four years of apprentice training. Minimum of 4,000 hours—two years—in the apprentice school, including shop theory, blueprint reading, shop mathematics (algebra, geometry, trigonometry) and experience in a toolroom, which is a part of the school. Technical knowledge of all machine-shop metals, machinery and equipment and of shop process is part of shop theory.

C. Experience: Before acceptance as a toolmaker at least another 4,000 hours of training in the plant toolroom, under supervision, must be added to the apprentice-school training; and then, after being graduated from the apprentice level, it is a matter of individual talent as to the time required before the learner can be considered experienced, or a real toolmaker. In special cases he may be counted as qualified after three or four years, but in general it will take about six or seven years after going into the plant toolroom to develop a man into a toolmaker.

D. Physical: Good health. Especially good eyesight. Muscular strength not required.

E. Aptitudes: Definite mechanical ability. "Feel" for machinery and tools, plus high degree of talent in manipulating hand tools. High degree of scholastic intelligence. Ability to do precision work to a very fine tolerance. Ability to stick at detail work, to reason and to concentrate. Pronounced ability in mathematics.

F. Personal: High degree of interest in building things with the hands as well as with machines. Liking for both hand tools and machines. Imagination. Patience. Ingenuity in adapting methods that are efficient. Exceptional honesty and thoroughness, reliability.

DIEMAKER

IT'S clicking!" Forty years a dieman and all the glee of a small boy when he gets the clock running after his father couldn't do it. There are times—rare times, but they do occur by some chance—when the die designer and the die engineer have done their best but the die resulting from their paper work isn't right, doesn't turn out practical, working parts.

And then the real dieman uses a faculty which he calls know-how and a more scholarly thinker labels as adaptive imagination. Whatever name we give it, true shopmen and craftsmen and foundrymen, too, know how they need it. And most especially does a diemaker need it. For the making of a die is an adventurous, adaptable, ingenious, on-the-firing-line kind of business. At least in the automotive industry, in the making of the huge dies used in those 440-ton mammoth presses that reach to the 40-foot ceiling of the pressed steel division, this is true.

Pressed steel adjoins the die shop, as well it must, for out of the die shop come huge sets of male and female dies to be installed in the jaws of some giant press which can stamp out, or "draw" out, an automobile fender in a matter of moments. Time has a money value to a diemaker and he works on a cut-and-try principle quite foreign to a toolmaker.

It's just a different kind of bent or interest as well as of talent—the psychologist says aptitude, the shopman says gift—that marks the difference between a real dieman and a real toolmaker. There are many men who are both toolmakers and diemakers, but in general a man is more competent at one trade and for that very reason *likes* that trade better than the other. The detailist and perfect precisionist prefers toolmaking. The man who does "rougher" (although he can, if required, hold a die to a ten-thousandth tolerance), quicker, more immediately demanding work is the diemaker.

In contrast to the toolmaker's five hundred details in one fixture, all drawn out for him and to be precisely followed, there are no such measured-out, detail drawings given to a dieman in the majority of shops, but he must supply—make for himself—his own detail sketches, working from a rough over-all or "assembly" drawing. Instead of building from minute directions his tool, as the toolmaker does, a diemaker has to "develop" his die.

After his details have been sketched out, if he is making a die for a small part, he will construct from a sheet of metal a template (which is a flat piece of metal, cut to the desired shape to serve as a guide) and proceed to cut his die to the shape of the template. His die must then be set on a die shoe which is finally mounted in a steel press. A test part is stamped out and results checked; after which, in some cases, the die must be altered in order to make the part conform to the original print. This template process is often used for small parts—brackets, license tags, the foot accelerator, and so on, where a model is not needed, although templates are also used in conjunction with a model.

Or the diemaker, working, for example, on the car fender, uses a model in wood or plaster of Paris, made in the pattern shop, in order to machine out a block of cast iron which is the die. The die is then set on a die shoe and the same process of mounting in the press, checking a test result, and altering the die is followed.

It is in the process of planning ahead and figuring the most economical way and most efficient way, considering cost of materials, avoiding waste, figuring how many pieces will run off the die he develops and figuring ahead to the time and motion cost involved, that the adaptive imagination of a dieman is so vital to his success.

If we said that an expert machinist must work with his head and his hands and his heart, it is doubly true for a real dieman. He must plan with his head; he must have skill with his hands; and, come what may, he must never give up the ship. In the very early days of the automotive industry the mistake was often made of putting the lowest class of labor in the die shop; it was a dirty, noisy place, generally right next door to the pressed steel, and since a strong back was sometimes needed for lifting bigger dies, the main requisite for the die shop seemed to be brawn. Brains and imagination and skill and that priceless faculty of know-how which shows up in quick adaptability for seeing through to the heart of a problem, getting the "bugs" out of things or licking a tough job, to use still more shop vernacular, were not expected from a man you put down in the die shop.

Then, as the leaders began to check up and figure costs a bit and watch for those little leaks of waste and extravagance that swamp a big boat in a hurry, they began to think about efficiency at the foundation level. They came to realize that material cost from the earth up is the primary cost in manufacturing. They came to computing how much money was involved in making, say, one set of dies for the two front fenders of a car. They counted up the cost of the material involved, the patterns made, the castings made, all the labor involved through to the point where the dies had been installed in the presses; and then they gasped, for these poor strong-in-the-back but a little weak-in-the-head huskies who were trying to learn the die trade were working on a set of dies that cost many thousands of dollars.

We are telling you all this about the money involvement so that you may get some faint notion of why it is that, to the men at the top of industry, you as a possible job applicant and career seeker in one of their companies are an important item. And they want you to feel the importance of any job of any size that they ask you to do. They also want you to feel that you're important to the whole team, no matter whether you're running an elevator or sweeping the floor. Now if you have all that it takes to become a real dieman you hold a responsible job; moreover, you're in a fine place to show how skillful and how practical you can be; but beyond that—just as with the rest of these artisans of industry—you have a chance to build a feeling of pride in your own highly necessary, highly unique part in the drama that is called American industry.

DIEMAKER

I. Duties

- A. Read assembly or over-all blueprint sent to him by the die engineer.
- B. Make sketches of details necessary in his plan for developing his die.
- C. Machine, out of tool steel or cast iron, a die. This is accomplished either by making a template, a single part made by hand, and working from that, or by working from a pattern sent to him by the pattern shop. In developing this die, consider the most practical and economical procedure, having in mind the purpose for which the die is to be used.
- D. Set die on a shoe, or heavy support, and then mount in a press.
- E. Check results on first part stamped out, and if not as desired alter the die until satisfactory.

II. WORKING CONDITIONS

Inside work in the die shop. The template room and the part of the shop where smaller dies are developed are relatively less noisy than the part where work on the bigger dies is done. Atmosphere is that of important constructive action going on at varying rates of speed where individual responsibility is very apparent. Some hazard from weight and size of dies being moved. Slight hazard from flying particles of metal. Periodic safety inspection.

III. WAGES

Hourly basis. Vary from apprentice starting rate (for training in an apprentice school) of 60 cents, with 5-cent increases at six-month intervals, up to $1.75 or more, depending on skill, experience, and section of the country.

IV. QUALIFICATIONS

A. Education—Essential: At least twelfth grade or equivalent. In school preparation put emphasis on mathematics, science-laboratory courses, and mechanical drawing. A more limited school background is acceptable only in exceptional cases. For example, a man with European background who had been in one of the good trade schools where academic and shop experience are combined, might pass tests showing adequate proficiency and aptitude for die making although he was not a graduate of one of our high schools.

B. Training: Four years of apprentice training. Minimum of 4,000 hours—two years—in apprentice school, including shop theory, blueprint reading, shop mathematics (algebra, geometry, trigonometry). Technical knowledge of all machine-shop metals, machinery and equipment and of shop processes is part of shop theory.

C. Experience: Before acceptance as a diemaker at least another 4,000 hours of training in the plant die shop, under supervision, must be added to the apprentice school training; and then, after being graduated from the appren-

tice level, it is a matter of individual talent as to the time required before the learner can be considered experienced or a real diemaker. In special cases he may be counted as qualified in two or three years, but in general it will take about five or six years to develop a man into a diemaker.

D. Physical: Good health. No physical handicaps. Stamina and energy. Good eyesight. Good hearing.

E. Aptitudes: High degree of mechanical ability. Skill in handling small tools and fine work, combined with ability to work with bigger tools and heavier materials. Ability in mathematics. Ability in logical, practical "reasoning-through" to the solution of a problem. Ability to visualize a practical, finished product.

F. Personal: Interest in and liking for both hand tools and machines. Imagination. Courage to attack a hard job and stay with it to the end, a successful end. Adaptability plus—in fact, enjoyment in the meeting of any challenge to his craftsmanship.

Part I - - - - - - - - Chapter 7

PATTERNMAKER

"YOU'LL never learn it from a book." This is a consistent statement signed, sworn, and subscribed to by high-grade patternmakers. "High-grade" means thoroughly qualified and successful. One of the men we're quoting started patternmaking at eighteen—that was in 1896, he recalled—and is now a follow-up man for a large pattern shop. A second man is the owner of the shop; he is also an old-timer; but the third man, about twenty-nine years old, has a master's degree from a university and has been working for five years on the bench. He is not ready to work as a layout man in the shop, and the superintendent and executives, all of whom can give an excellent case history for each employee, agree that his know-it-all attitude held him back for a long time. He is not yet a high-grade patternmaker, but he is finally seeing that there is more to it than he had at first thought, for he too volunteered the remark, "You'll never learn it from a book."

Refusal to push ahead a man, even though he is brilliant mentally, until he has mastered the essential skills of his trade and until his attitude is such that he can say, along with the founder and builder of the business, "I learn something new all the time—I haven't all the answers, no man has," is a primary principle among the men in a pattern shop who develop apprentices into journeymen patternmakers. The old-timers are far from unappreciative of "book learning." They are eager to learn any new methods developed through the research of schoolmen. And they are glad to employ college men, but they are insistent that the apprentice (as the novitiate or greenhorn must always be, whatever his age) shall demonstrate true readiness to progress.

A college education in itself is not the dominant factor, for good or for bad, in this matter of quick progress in learning patternmaking. There was another college man in the shop who was graduated to layout man three years after he was hired.

And in that pattern shop there was every kind and description of boy and man at all stages of learning. There was an acrobat from Barnum and Bailey's. He had learned the trade but later on had run off with a circus. Yet there he was, during the wartime need, making very good patterns, they said; a little slow at seventy-eight but a fine patternmaker of the old school. There was a lad of eighteen with a sensitive face and what the foreman called a fine pair of hands, who said—in answer to the question, "How do you like this kind of work?" —"I love it!" But there was also a bright, clean-cut boy there who said, "It's too hard work. I'd rather be outdoors driving a truck."

If you who read this are thinking of a pattern as anything like the tissue paper which a dressmaker pins on cloth and cuts around to form the parts that are sewn together to make a dress, you must forget about that kind of pattern. A pattern, in industrial language, is a form, either wood or metal, made from a designer's blueprint and used to make castings of aluminum, steel, or some other metal.

For one casting of an aircraft sixteen-cylinder crankcase, for which a wood pattern equipment was made, it took 160 core boxes. That means something! You'd only know how much it means if you were to attempt to plan the molding and core assembly and finally make the boxes. We had rather despaired of getting into words a full picture of how a wooden pattern is built. In fact, the whole business seemed hopelessly confusing to a layman.

We are speaking of wooden patterns for experimental castings or light production only. Quantity production calls for metal patterns, either aluminum, brass, or iron, and involves an entirely different phase which would be so lengthy and complicated that we will not try to deal with the subject at all.

The basic principles of pattern work must be mastered first in wood; for an apprentice in metal patternmaking has a serious handicap owing to the fact that the shape or form is created by the wood patternmaker from which the metal casting is made to be completed as the metal pattern.

Experts told us that it took more than we could ever describe in a book to be a patternmaker. "Why," they said, "take the same job—the same casting to be made. Suppose you put two fellows on it. You wouldn't, you'd give the job to just one. But suppose you give it to two men, what happens? These two fellows will first mull it over; then they'll putter around drawing up their plans; and if it's a big job I'll lay you ten to one you can't tell from the looks of the two patterns they produce—the way they build 'em up, the different size and shape of the parts of the pattern—you can't tell, I say, from looking at 'em that those two patterns are going to turn out just that one casting absolutely according to specifications. Do you see what I mean?"

No, we didn't see what they meant. It sounded worse than anything in the line of shop talk we'd heard before. But we see now. And the reason we see and have come to have great respect for patternmakers is that we went to study the subject, as best we could, at the source. We watched and we talked to the men who have made the patterns for some of the most famous of our aircraft engines—

ours and British too. They are still working on improved designs for aircraft.

The owner of the particular company we were snooping around in was a "natural." He knew that for one of his more complicated patterns, a certain crankcase he had in mind, the shop had put in 9,000 hours of work. These and other statistics were at the tip of his tongue. But, beyond that, he knew all about his employees as individual people, and he knew that it is best, if you think that you want to be a patternmaker, for you to weigh well the hard road ahead for you. It is best to accept the fact that you'll have demanding work to do—tedious, exacting, but withal fascinating if it is the right work for you.

All experts are in agreement that the faculty of visualizing a finished pattern from a general blueprint and then having enough imagination—"adaptive imagination" is the term we've borrowed from our scholarly friend—to lay out and then build up the pattern, is the essential faculty without which a patternmaker just never will be really a patternmaker. It is also necessary, in order to be thoroughly intelligent in this highly specialized field, that a man have knowledge of and contact with the foundry; and actual experience there is best of all.

A pattern, either metal or wood, is primarily a model or form of any shape or design from which a casting in metal is desired. This covers every conceivable metal casting, from an ordinary paperweight to a locomotive, battleship, airplane, or tank. In fact, practically every metal piece of anything you see anywhere in use was first created and brought to life by a patternmaker.

On metal parts such as steel forgings, that require no patterns, a wood model is made which brings to life the part that is to be forged and shows the men who are creating a die just what their problems are.

PATTERNMAKER

A great deal could be written about patterns, but the coverage would be so vague that we had better leave you with this thought: patternmaking is indispensable.

High-grade patternmakers have the same tendency that toolmakers have to do more thinking and doing than talking. However, their modesty—their under- rather than over-statement—means no lack of feeling for the job or career that is theirs. After watching one of the older men doing a beautiful piece of detail work on a core box, we ventured the same question we had asked the young apprentices, "Do you like this work?" He straightened up and looked us over before he committed himself. Somehow we felt as though he wanted to give us a true picture of all the sweet and the sour that there is in the years of a patternmaker's life, and yet he knew he couldn't get it into words. Still, we got the feel of it in what he said, and maybe you will too. "It gets pretty tedious," he said. "Of course, there's different jobs come along all the time. But these new aircraft designs, they're pretty hard to figure. There's a lot of grief." A tired expression came over his face and he looked down at the bench for a moment or two. Then as if he was bound to help us to get more understanding he went on, "You see, the old tables for shrinkage, they're all upset. If you were to make a solid casting the book rules would hold; but this aircraft stuff is hollow in places and the angles and curves keep changing on new designs, and you can't be sure just how it affects the shrinkage but it does. You see, there's a lot of figuring things out, to this business."

He hesitated, then kept at it to tell us; we felt he knew he was not an articulate man, but it was like the way he kept at it to build his pattern—he was bound to do his best. "You see," he said, "I worked on that new design for the Rolls Royce; that was my last job. Why, I took three months on it. It got to be pretty tedious. But then"—and the look in his eyes was different as he wound up—"but then, when it was done, it wasn't a job you'd be ashamed of."

PATTERNMAKER

I. DUTIES

- A. Read the blueprint drawn up by the design engineer.
- B. Visualize finished pattern and its adaptability for practical molding.
- C. Consider metal shrinkage. (For example, iron is ⅛ inch to a foot, aluminum 5/32 inch, brass 3/16 inch, cast steel ¼ inch. However, an experienced patternmaker will realize that standards for shrinkage vary with shape and construction of casting, especially in aircraft work. Use benefit of previous experiment and judgment.)
- D. Make a layout—detail of construction of pattern, considering shrinkage and the balance of the pattern.
- E. Build up or construct a pattern and core boxes.
- F. Check pattern by measuring all details and comparing it with blueprint and layout.
- G. For final tryout, make a mold of plaster of Paris to check fitting parts.

II. WORKING CONDITIONS

Inside work. Wood pattern shop very clean and relatively quiet. Metal shop somewhat noisier, but both shops have a pleasant, orderly atmosphere without pressure or confusion.

III. WAGES

Hourly basis except for foreman, who is on salary averaging about $135 a week. An apprentice earns about 65 cents an hour. A journeyman averages $2 an hour. A layout man averages $2.35 an hour.

IV. QUALIFICATIONS

- A. Education—Desirable: Twelfth grade. In school preparation put emphasis on mathematics and science and mechanical drawing. Experimental laboratory courses are recommended.

B. Training: Five years of apprentice training under supervision before a journeyman's rank is attained, except for unusually talented and otherwise able apprentices. (Pattern Makers' Manufacturing Association cooperates with the American Federation of Labor Pattern Makers' League of North America in establishing regulations for apprentices. Three men from the union and three men from the Pattern Makers' Manufacturing Association talk with each applicant who wishes to sign an apprentice contract.)

C. Experience: The promotion from apprentice to journeyman to layout man, possibly to foreman, supervisor, follow-up man, or executive position in a pattern shop, is completely dependent on the individual's talent, character, and ability to mount the ladder, considering always the particular shop situation in which he finds himself.

D. Physical: Good health. Good eyesight. Physical stamina and endurance. Ability to take periodically extra stress and strain, nervous and physiological.

E. Aptitudes: Ability to judge relationships, especially spatial. Ability to visualize a whole and its parts. Talent in doing fine work with the hands, finished, precise work. Reasoning ability. Concentration. Imaginative and adaptive capacity.

F. Personal: A well-adjusted personality. Pride in doing a job well in every detail and in seeing it through to a useful result. Persistence and patience.

Part 1 - - - - - - - - - *Chapter 8*

MACHINE REBUILDING AND MACHINE REPAIR

GOD put all your brains in your hands.' That's what an old Russian told me once. He'd been sitting out on his back porch watching me build some furniture over in my back yard. Well, I did a pretty fair job on it, if I do say so; and that's what he told me—God put all your brains in your hands. Now what he really meant, the way I figure it, is this: God gave you the kind of brain that means you can learn about building things—how to do it—and, beyond the knowing, you can make your hands do what your brain tells them. It's a kind of a talent a man may have; with it he can be a good mechanic; without it he can't be a good mechanic, and he'd better not go into machine rebuilding or machine repair. I know that. I've been at this job for fifty-two years. A fellow can be a good production hand, especially the way they build the machines today—and they're getting better and more foolproof all the time; but he's no good to go into this department unless he's a mechanic."

"Dad," as everyone calls him, has built far more in all these years than the machines he has put together; he has built the enviable reputation of being "just about the best mechanic around this plant"; and that means something in a plant that has more old-timers in the automotive industry than any other plant in the country, and a lower labor turnover. He has had and still has some mighty keen competition to meet; but the men who called him "about the best" are not the kind who spill over or talk applesauce. Dad has little patience for the people who say of a boy, "Oh, you'd better let him work with his hands; let him learn a trade; he couldn't do anything with his head." A boy may not have the right kind of brain for one kind of work or he may not have any liking for one kind of work, but there's some work he can do and there's some place he'll fit.

Now if he's to learn a trade he'll soon know that the head-work end of it is nothing to be scoffed at, to be belittled by purely speculative theorists. You who are thinking about possible careers in industry and might, perhaps, jump too far and too fast into the future had better read on at this point and hear about the importance that Dad attaches to training and getting down to fundamentals. He himself was bound out for four years for board and clothes as an apprentice and then, he says, they gave him $150 and said, "Now get out of here, somewhere away from this shop and your home, and see what you can learn." He got out and he worked in many kinds of shops and towns and he got new ideas everywhere. Of course, the joy in life to him right now is that he is still getting new ideas; and he is still going on with his career—rebuilding, improving, repairing the milling machines and the lathes and the gear grinders that themselves build a machine in which people drive down the street to their work or drive out across the nation to new horizons.

And yet, with all the changes that have come and will keep on coming, Dad, the old-timer, says that the fundamentals in machine rebuilding are still the same and that he is continually glad that he learned them thoroughly: how to draw his own sketches; the shop mathematics he has needed; the book knowledge acquired as it was essential and applied immediately to the practical doing of a job. He and the other men in that department are great learners. Many of them have gone to technical colleges at night to keep up with the new and better methods. Many of them, who are able enough, have moved up to the paper-work master-mechanics division. Sometimes it would seem that they have been stimulated by the very immediacy of their need. For these men must understand all types of machines; they must devise, in some cases, improved ways of rebuilding or retiming old machines; they must keep broken-down machines producing by makeshift methods and ingenious devices until the foreman says, "O.K., Mike, I can spare her now for a week or so." And then they must "give her the works"—tear her down to the frame and make her as good as new if not better. Truly, men in responsible jobs of this kind have had what the educators call a "felt need" for learning. Sometimes a green man in machine repair will keep ahead of the game by eternally keeping his eyes and his ears open, by watching the man who is doing a job he himself has never tackled. It's a challenging business and an absolutely essential business to keep all the machines of a big productive plant in efficient working order.

There's no doubt that if you have a strong attraction for the job of trouble finding and trouble fixing in mechanical matters, or if you like above all things to take anything mechanical apart and then rebuild it, you are likely to find yourself, after a long apprenticeship, a qualified and a satisfied man in the department of machine rebuilding and repair. Interest is not the whole story. But, as one of the foremen said, "A fellow has to be in the work he likes or it's hard to get along with him."

Fortunately the department has so many varieties of work, of differing degrees of skill, that it is possible to adjust a man, if he really likes the whole business, to the job that he can handle. Sixty per cent of the men are all-round men who can handle anything, but the others are specialists, such as hydraulic men or drill-press repairmen or lathe men or milling-machine men. There is one man who is very much of a specialist, with twenty-five years of experience on scraping bearings. He needs to work hard, scraping against bronze with an inside scraper of steel—a lot of forcing himself to the drudgery of it, especially when it's a very dirty scraping job. "It's no good if someone else forces you," he said, "but it's different—it even feels good when you've finished—if you've forced yourself." There's a great deal of judgment to the job of scraping, say, the big bearing on a Newton milling machine. It tapers, and you must scrape down just enough but not too much. You must leave just the right allowance for oil and for the play in the bearing, but the tolerance mustn't be too fine so that it will freeze. Then suppose you have a gib on that same scraping job and you get it smooth and clean but it's too small to fit back right. Then you've got to figure if you can add a piece of steel by "sweating" the parts together, and do a good piece of bench work with a hand file so that no one can even see the seam where the extra steel was built on or the parts "sweated" together. If you can do this, and do it right, you'll have saved the cost of a new gib and the time of filing it down to fitting size.

Men who can save costs are valuable in machine rebuilding. These men must be very thorough and must take plenty of time to be sure that the machine they've so carefully rebuilt from the frame up is truly rejuvenated after its years of work and wear and, yes, tear too, when it is hard pushed in production. They must be men who can carry their share of the load and not just dub around in the section where several men are working on a rebuilt job, or they will soon find that the other men are going to make them anything but happy, for no one intends to carry a dumbbell.

The know-how that distinguishes an expert, outstanding machine repairman in contrast to a rebuilder is the faculty of being able to put his finger on the trouble in a few minutes where an average man might take days to find it. It is obvious that this time-saving, money-saving, diagnostic intelligence, perhaps the product of very skillful deductive reasoning, seems to make a veritable wizard out of its owner. A man like that is the man everybody wants. Foremen telephone in an emergency and they say, "Don't send me anybody else. I want John So-and-so up here. And I mean it, Bill."

The machine-repair department is a challenging place to work. They will take you on trial, be very patient with you, try you out from A to Z on the possibilities of getting you and one of their many jobs to fit together, to "click." If you can't make the grade, they'll tell you; they'll find the place in the plant where you can fit. But if you have something on the ball in their line of work, the men who keep the machines running that keep the parts flowing will more than just accept you. They'll take you to their hearts, although they'd surely never put it in words like that—words of any feeling, unless perhaps profanity of a sort shows feeling!

MACHINE REBUILDING AND MACHINE REPAIR

I. Duties
   A. Machine rebuilding
      1. Tear down machine to the framework.
      2. Inspect each detail; lay aside parts that are in good condition; classify remaining parts as those to be replaced and those to be repaired.
      3. Get from the stockroom, or if necessary build in machine rebuilding shop, the parts to be replaced.
      4. Send parts to be repaired to the specialists in the shop who work on various types of repair work.

5. Rebuild machine in every detail and install same precision as when machine was new.

B. Machine repair
   1. Become familiar with each type of machine in the particular production department to which he is assigned.
   2. Make all repairs necessary to keep all machines in the department operating efficiently.
   3. If more than minor repairs or adjustments are necessary, keep the machine running until foreman can spare it for rebuilding.

II. Working conditions

Inside work. For machine repairmen the same conditions as those prevailing in various production departments: generally noisy, slight hazard from flying particles of metal. The shop for machine rebuilders where more expert work is done is relatively clean, quiet, and in general free from any tension or pressure. Shop where specialists work on repairing is like any other machine shop.

III. Wages

Hourly basis—from 60 cents, with 5-cent increases every six months (if the apprentice attends an apprentice school) to about $1.50 or more, depending on section of country, ability, and company policy.

IV. Qualifications

A. Education—Desirable: Twelfth grade or equivalent. In school it is well to put emphasis on mathematics, science, and laboratory courses.

B. Training: Valuable apprentice training in machine rebuilding and repair is often found in the navy machinist or railroad machinist experience. Four years of such training seems to produce men who have ability to follow through a rebuilding or repair job without asking that parts of the work be done for them. Four years of apprenticeship in any school or machine shop that has machinery of the same nature as that used in industry is desirable.

C. Experience: Qualification as an experienced machine rebuilder or repairman depends on individual initiative and ability to progress, to learn what is needed and to develop skill and speed. There are specialists in the machine-repair shop on various phases of the work; long years of experience on one specialty—for example, maintenance of gear equipment—makes a man an expert.

D. Physical: Good health. Ability to be on feet eight hours a day. Stamina. Energy. Good eyesight and hearing.

E. Aptitudes: Mechanical aptitude. Spatial judgment, good sense of rhythm and timing.

F. Personal: Keen diagnostic ability where source of machine trouble is obscure. Quick decision. Perseverance. Inventive capacity and ingenuity. Willingness to learn and to change ideas with changing developments.

INSPECTION

THE leaders in industry have recognized, ever since mass production began, the obligation and responsibility of their respective firms as far as quality, which meant not only durability but also safety, was concerned. Positive gauging is also demanded by industry in order to make successful the interchangeability of parts. This is necessary because of the human element—which laboratory scientists have always recognized as fallible.

But after Pearl Harbor the work of inspection in industry became so important that the government set up its own quality-control standards and supervisory inspection. Life and death and victory itself were involved.

We are now concerned with the task of fighting for an enduring peace. And whatever product industry of any kind shall presume to send out over the world, the integrity of our nation will, in the long run, depend on how carefully each individual part has been checked and gauged and measured by some worker in the department of inspection.

When we wrote of a machine operator we imagined him as becoming a foreman and we said that the treatment of people who did the real producing was vital to the future of industry. We are no less aware of the importance of the treatment of inspectors and also of the essentialness of both honor and efficiency in the department of inspection as far as the success of big industry is concerned.

This seems a long way from a picture of a person who makes a career out of being an inspector. To swing back from national integrity to one little cog in the machine or tool of society (as sociologists might think of all industry) we may well feel that we need a big push. And yet, if you'll let your mind's eye carry you to the old-fashioned rope-swing hung from the big limb of a tree, the harder we push and the farther you soar into the air on one side of the limb, the surer you are to swing farther back on the other side.

No nation is any better than its people. No industry is any better than its workers. No product is any better than its inspectors. And the mainstay of the inspection department is a man or woman—for women make good inspectors—who can take monotony and never relax on responsibility.

If you hope for a broader career in inspection than that to be found in checking as part of production, you will do well to forget security. The idea of advancement from the repetitive business of gauging piece after piece, day after day, until, year after year, a certain piled-up seniority makes you the one who may become a supervisor in inspection, is a very realistic picture under the present industrial setup. But it's possibly too slow a process for you who are seeking expanding careers in industry. We told you that a machine operator could find contentment in knowing his own special machine; an inspector can also know his own special job and like it. There is a man who is deaf and dumb in one section of inspection where incoming material is being checked, and the foreman says he wouldn't change him for ten men—he has no distractions.

You can find a steady, useful job in inspection. And under the type of supervision where the worker's interests and personal traits are considered (either leaving him with his same familiar duties if he dreads change, or moving him about if he responds to variety) you can be happy in that job. However, for a broader career in inspection or for advancement to other departments of an industrial plant, you will do well to seek further training and then forget seniority, providing you can get broader experience or responsibility by so doing. It may be necessary to change to a new company making a different product where your newly acquired, specialized training in inspection will be useful. In any case it is up to you to plan your individual progress and demonstrate your ability. And the very nature of your experience in holding conscientiously to a high standard in quality control, providing you also have mechanical know-how and production experience, will prove eventually to be an excellent steppingstone to executive positions.

But if you continue to verify the exact dimensions of one particular purchased part where incoming material is being checked; or if you continue to do the same verifying for the same production piece sent into the inspection crib by the very same machine operator year after year, you are a vitally needed member in the ranks of industry in a vitally needed department.

It occurs to us that a certain stressing of the more detailed, monotonous, repetitive side of the life of a production inspector may be due to our once watching a woman inspecting a hairspring. In fact, we are haunted by that hairspring! It was about a quarter of an inch long, very tightly coiled, and that woman counted all day long the number of hairbreadth coils in each tiny, oily and (as we still remember it) devilishly elusive hairspring. However, inspection is not all hairsprings. Since that day we have seen about the most ambitious and intelligent young lady for whom we ever found a job operating a magnaflux machine in inspection, and she was as competent, absorbed, and happy in her work as another woman we recall who has earned a Ph.D.

in chemistry and who works in a special laboratory which she herself developed for industry. And we have seen a man working on a comparator in the toolroom who was as absorbed in his inspecting as any of the toolmakers near by. Your liking for inspection, like your liking for many phases of industry, depends only a little on the job; it depends mostly on you *in* that job. For, regardless of mass propaganda for mass consumption, and even if you have a twin, there's no other mortal on this earth with exactly your make-up and your moods, your interests and your personality.

Inspection in industry has wide ramifications and interesting variations. And if you have what it takes in the way of trainability, reliability, accuracy and judgment, you'll undoubtedly welcome every experience along the way which helps you to grow from the man who tries first the go-end and then the no-go end of a snap gauge on one small part, to a man on the staff of the plant manager with important decisions to make regarding all plans, layout, material, and personnel which in any way affect the quality of every item, purchased or made, of every product turned out by that plant.

PRODUCTION INSPECTOR

I. Duties
   - A. Working at an inspection bench on the floor of the shop, spot check, with specified gauges, each machine operation performed on any given part being produced in that group.
   - B. Give 100 per cent visual check to parts produced for finish—no burrs, stripped threads, seams, cracks, scratches, or rough and chattered finish.
   - C. Become familiar with proper use and care of all type gauges: length, snap, thread, plug, flush-pin, profile and fixture type.

II. Working conditions

Whatever shop and production conditions prevail throughout plant.

III. Qualifications

A. Education—Desirable: Eighth-grade graduation or equivalent.

B. Training: As with machine operator, depends on job. In general, two or three weeks is long enough to adequately train a production inspector.

C. Experience: Certain regulations as to seniority prevail, together with merit and ability, in deciding promotion to higher-paid classifications.

D. Aptitudes: Interest in accurate, careful, thorough, and precise work.

E. Personal: Responsibility. Loyalty to company rules and standards. Patience in detail and repetitive work. Honesty. Reliability.

LAYOUT MAN

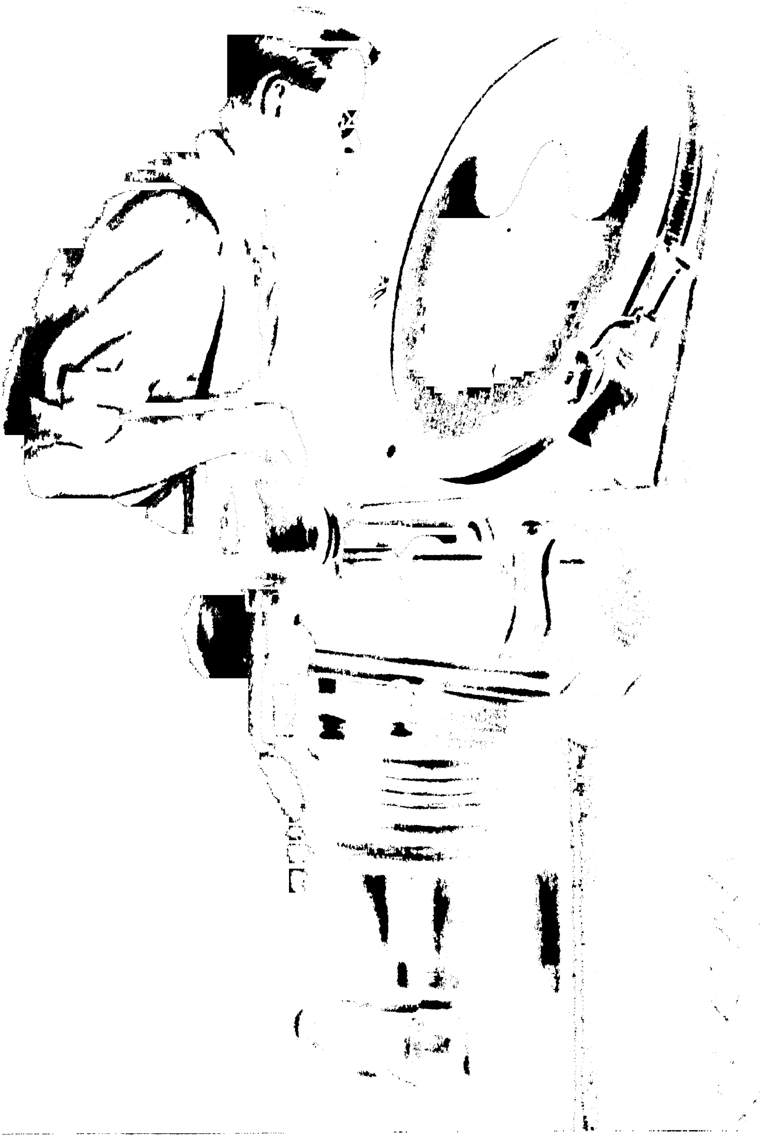
I. Duties

A. For the particular part to be checked as to machinability, consult the engineering blueprint.

B. In case of either casting or forging, check part to determine if in the process of manufacture the specified amount of stock has been allowed for finish.

C. If the check shows insufficient stock, or excess stock for finishing, make notations for proper amount of correction and forward to manufacturer or to the plant foundry or forge.

D. In addition check each part to make sure that the engineering design has been properly followed. For example, in the case of a gearshift lever check the form; for gear blanks check the face angles and also the concentricity of the bore with the outside diameter. In the case of a complicated automotive assembly, for instance, that of a



frame, check over-all length and width, location and spacing of cross-channel members, location of engine-mount brackets, body-mount brackets, the spring-hanger brackets, front- and rear-axle-mounting brackets, and running-board step brackets (when optional).

II. WORKING CONDITIONS

Inside general large office, a layout room.

III. QUALIFICATIONS

A. Education—Desirable: Twelfth-grade graduation. Put emphasis on mathematics. If technical high school is attended, blueprint reading and knowledge of gauges may be obtained.

B. Training: If not acquired in school, knowledge of mathematics (algebra, geometry and trigonometry) and knowledge of blueprint reading must be acquired. Training in detail of layout work varies in accordance with volume and type of work. If apprentice-school training, including machinist experience, has not been obtained, at least a year of shop training in machine operation is necessary.

C. Experience: In order to become a real layout man, about four or five years of experience in the layout room is necessary.

D. Aptitudes: Interest in mathematics and in precision work. Analytical and reasoning ability.

E. Personal: Patience and accuracy in detail are necessary. The ability to get ready and cheerful cooperation, to show tact in dealing with manufacturers and production supervisors as well as with co-workers, is essential for advancement to supervision.

SUPERVISION

SOMEONE said to us when we were talking about the writing of this book, "Don't put in anything about ladders."

"Where are the new *leaders* coming from," we said, "if there are no ladders?"

"Oh, the leaders will spring up. Don't talk about them. It's the masses we must worry about. A thousand people go through that gate before a general foreman walks in. Four thousand show their badges before a superintendent drives through. Think of the masses and write for them."

So we began to think about the masses. It was depressing. A "mass" seemed to us like a great stodgy, stupid lump of human material. For some strange reason we thought, "The hungry sheep look up and are not fed." Inevitably there came to mind the old hymn about the ninety-and-nine —just one sheep had been lost and the shepherd was out on the hills looking for it. And suddenly we felt we had the answer. Christ himself was an individualist. As a shepherd He knew each sheep.

"Think about the masses." You can't do it. It's too vague. It becomes Nick the janitor; and it becomes his long siege in a hospital and the wife he was so glad to get home to; and it becomes that son of Nick's who wants to buy a home of his own and Nick must ask the director of personnel if this time is right for Tony to buy; and it becomes the picture of Nick making a dunce cap for the teacher in the apprentice school or of the mouse he kept for a pet.

The masses? Who are they? Why, they're *Mike the machine-repair expert—and do you remember how he scouted* around in seven different departments before he found that air cylinder, the one he said an old pal of his let him "borrow"? That was to help out one of those new women who couldn't shove the clutch that tightened the collett; she'll never forget that, it made her whole day easier.

You see, don't you, that any crowd is only you and we and a lot of people like us?

When you think of the masses as they really are, as friends or even as foes, they become real and you can get down to cases. And then you can talk about leaders. For all those people, those hundreds or even thousands who are going to walk through that great factory gate before a foreman walks through, are the ones who count the most in that foreman's climb up the industrial ladder. Without followers no man can be a leader.

So the problem for the man who would be a supervisor in production seems to be: what does it take, what must I have, to win followers?

The reason that leadership is the vital consideration for a man who wants to be a foreman is this: "Twenty years ago ninety per cent of my time was spent on mechanical problems and ten on human. Today it's reversed." That's one supervisor's opinion and the facts will bear him out.

We shall, in this sketch, consider a foreman's job rather than the duties of a man below or above him, for we can't cover the whole territory of supervision in production. A supervisor in industry is generally the broad term given to any man who oversees the activities of any other men, whatever the size of his group, the nature of his work, or the scope of his authority.

Supervisors are concerned with three functions: getting reliable knowledge that is useful; developing attitudes about *company policies and about human relations that prove helpful* in securing improved production; and developing greater technical skill that will lead to better production. Their work involves management, supervision, and training.

Now we come back to that direct question, what can I do to be a foreman, to be a leader—that is, to win followers? You have a job to do, but the main part of it—building identical parts to be assembled in a finished product—must be done through the effective labor of individual machine operators, job setters, clerks, and assistants.

How can you get them to go to work, stay at work, and work well? In the first place, you must have a greater joy in getting other people to do work than you have in doing the work yourself.

In the next place, you must honestly have an abiding interest in human beings as individual, changeable personalities who, like you, thrive on appreciation and building up. You must get a decided kick out of it when you can so train and help a man under you that he begins to grow up and get ahead; and you must fight for his right to do this even if he gets ahead of you.

Furthermore you must have the faculty of losing yourself in the accomplishment of an end; and you must make this way of doing so full of zest and delight to others that it becomes contagious, and a spirit of teamwork to score a goal is the accepted order of the day. Next you must win allegiance to your company by faith in the soundness of its policies and by an absolutely impartial and fair interpretation of its rules.

And last of all you must have standards—affecting the quantity and quality of work produced, the order and efficiency of your whole department, and the courteous, considerate treatment of all who work or visit the place, each *one to the other, and you must never, for any reason at all,* lower those standards.

By having such attitudes and by following such procedures you will win followers and you will be a leader. You will not become one over night. The men in big industry who have become foremen, general foremen, and superintendents in production have won their laurels by deserving them with, of course, a few notable exceptions in any large company. However, these exceptions (and what trouble they've often caused!) are rapidly being weeded out under present-day standards.

To give you some idea of what a foreman may think about preparation for such a job, suppose we drop in and visit a bit with the man in charge of an automatics department. He says that he has plenty of time and that he is glad to talk to us; and he is interested in thinking ahead to the type of young man who will some day replace him.

We know that his reputation in the plant is high with both labor and management. And before long we see, from the easy, assured way with which he makes a decision and delegates responsibility and authority when he must personally attend to some urgent matter, that he is both a rare executive and a master of detailed knowledge.

Recalling Tom Blake's early training takes us to New England. It was at Brown and Sharpe's in Providence, R. I., that a personnel manager did some missionary work on a young fellow who hadn't finished high school. He told him there was always a better way to do things. With his art of suggesting and inspiring he stimulated Tom to get his high-school diploma through going to evening school, which he literally raced through, pestering the teachers for more and more work. It is easy, even after thirty years, to see under the calm, big man—one minute rather reserved and dignified and the next hearty and jovial when a bit of humorous aside sets off a series of chuckles—that young Irish lad who went after what he wanted with the steady drive of a steam engine, and yet charmed so easily, and so honestly won the hearts of everybody around him. It must have been that same genuine sincerity and self-forgetful earnestness, that faculty of getting right at the root of the job at hand, which stood out then as it stands out today.

Tom is mighty certain that a young fellow must know what he is after and then never get sidetracked. His own learning and training years, to fit him to be a foreman for automatics, took him to three machine shops in New England (where, he says, they move a man from one machine to another until he's an all-round mechanic), to Long Island, to Baltimore, and finally to Detroit.

When he had got all he could learn out of a job, he picked up and moved on. Once he moved back from assistant foreman to being a job setter in a different shop because he needed to know more of a new and better automatic which they had. He earned less money; he had to get up at five instead of six, for it took three street cars to get to the new job. Everybody was sure that time he was a fool.

He never got sidetracked and he knew his own mind about many things; for instance, he found time to become so expert at sailing canoes and racing a surf boat with a sail on it that he still keeps a newspaper picture of the champion athlete he was; and he surely didn't call it being sidetracked when he reared a family of seven children.

As he told about the strenuous, hard-driving bringing up that made him a real foreman, there are three pictures of Tom that stayed with us. He was so anxious to get books to read that he used to go around the neighborhood and ask if they had any he hadn't already read. One day he struck gold. It was a big brick house with a "captain's walk" on the rooftop—a little beyond his usual haunts, but he dashed up the stoop and lifted high the brass knocker.

A maid ushered him into the presence of two old ladies. He blushed a bit as he saw the silver service and the plate of cakes and they asked him if he'd sit down and have a cup of tea with them. Well, the upshot of it was that from then on he had the run of a library that *was* a library; it had belonged to the ladies' brother, a sea captain. Smollett, Dumas, Victor Hugo—don't tell us those gentlemen didn't help Tom when he came to handling his fellow men. That was a lucky day when he made friends with the sisters of a sea captain.

Sitting in the smoking car on his way up to Boston, Tom was bound for the United Shoe Company, as he had heard they were running the first assembly line. Seeing what that could mean for industry, Tom was bound to investigate. On the seat beside him was a man who owned a shoe factory, ex-Governor Douglas. ("I still wear Douglas shoes," says Tom.) He doesn't know which one of them first spoke to the other—we guess they were both the kind to make friends. But he has always believed something that Governor Douglas told him. "Try if you can," the governor said, "to go a little out of your way to do some favor for some person. Do it every day, if you're lucky enough to get a chance. Don't do it to tell of it, or for any return. But in this world there's a law of compensation, and someday, somehow, it'll come back to you—you may not know just how, but do the kindness, anyway."

The last picture is of a rather harassed Tom. He is in Detroit. He has sold his home in Baltimore. His family is waiting, ready to be sent for, although his wife is a little anxious over such a long, uncertain move, and Tom finds no opening at the Burroughs Adding Machine Company to whose manager he had a letter. It is about four o'clock of his first day in the city. There's a street-car strike and Tom is worn out, discouraged and footsore. He asks if they know of anyone who does have an opening for an automatics foreman. Someone speaks of an automobile company. "I heard they need a man," he says, "but it's much too far to walk; wait for the cars to be running." You've probably guessed the answer. Tom grins, thanks them, and at six o'clock he has reached the plant and the job is his. He has been there for twenty-four years, becoming the head of a large and important department, and every day, he says, brings him new problems and more fun.

Tom Blake is a man who climbed, round by round, up the production ladder—machine operator, machinist, job setter, assistant foreman, foreman, general foreman, and head of department.

Industry has not one but many ladders, and on each round there is a platform built out there, safe and strong, by the men who found at that particular point satisfaction in achievement, adjustment, contentment, and a career.

There are many people who like industry. We all like the things and the people to whom we have something to *give*. It seems to us that a man on any round of a ladder in industry—a follower or a leader—who keeps on giving of himself to his work is going to be able to say with Tom Blake, "I like this work. Every day I see more problems. I like it."

SUPERVISION FOREMAN

I. Duties

A. Specific duties vary in different departments. The general responsibility is to promote the production (whether building, inspecting, assembling or shipping of goods) in accordance with assigned schedules. This responsibility is met by means of supervising, training, coordinating, and harmonizing the work of those men under his leadership.

B. A foreman's immediate problems vary from day to day. He must always "put first things first" in order to get results. However, he should also try to plan and meet a daily procedure such as the following:

1. Check man power. (Absentees) Place men properly.
2. Check floor for shipment. See that parts which are through inspection are being shipped.
3. Check incoming material—see that enough is on hand.
4. Check machines (replace finished jobs with new work).
5. Check with all operators—*every man every day*—as to condition of the machine, the tools, and also of the operator (his health, what's on his mind, his efficiency on the job, the quality and quantity of his work).
6. Review the information you've secured from this check, and contact sources to take care of daily progress (master mechanics for tools, planning for materials, employment for personnel, etc.).
7. Plan for next day. Check releases. Watch schedules. Make out all reports (paper work). Take care of special problems (this is generally done as they arise). Confer with steward as to grievances and with individuals when they need special help. Take care of maintenance or safety improvements.
8. Where need is discovered, give extra training to either new operators or old ones with unfamiliar jobs.

II. WORKING CONDITIONS

General shop or production conditions. Usually noisy. Work, in the main, is in the partitioned-off foreman's office and on the floor of the department.

III. QUALIFICATIONS

A. Education: It is desirable for a man to have at least a high-school diploma. A college-cooperative course provides a splendid background. However, with the right attitude and personality a man may be considered qualified to start his training for foremanship if he can write legibly, read understandingly, has a good working knowledge of arithmetic, and possesses a high degree of native intelligence.

B. Training—Desirable: College-cooperative education as recommended. This will provide variety of industrial experience.
An alternative is the regular four-year apprentice-training program as outlined previously (see "Toolmaker").

C. Experience: It is desirable that a man secure as broad and varied a production and industrial experience as he can manage in order to fit him to handle the human-relations and technical problems of supervision.
The amount of time it will take for him to qualify and secure a foreman's position is dependent mainly on his personal ability and to some extent on general economic conditions.

D. Physical: Good health and stamina. Nervous energy and stability more essential than muscular strength.

E. Aptitudes: Emotional maturity. A philosophical and humanistic trend of thought and feeling. (He must be a man who "believes in something" and has faith in people.) More objective and "outgoing" than introspective. Imagination, ingenuity, patience, tolerance, humor, sincerity, persistence.

As an indication of the importance of personality and self-development for a foreman, we quote the following: "The supervisor's best way to improve his department is to improve himself." [1]

[1] "The Industrial Supervisor," by Amiss and Sutton, Ronald Press Company, New York. 1944.

WORK

All true Work is sacred; in all true Work, were it but true hand-labor, there is something of divineness. Labor, wide as the Earth, has its summit in Heaven. Sweat of the brow; and up from that to sweat of the brain, sweat of the heart; which includes all Kepler calculations, Newton meditations, all Sciences, all spoken Epics, all acted Heroisms, Martyrdoms —which all men have called divine! O brother, if this is not "worship," then I say, the more pity for worship; for this is the noblest thing yet discovered under God's sky.[1]

—THOMAS CARLYLE, "Past and Present."

[1] "Reprinted from Essay On Labor by Thomas Carlyle in Oxford Anthology of English Prose with the kind permission of the publisher, Oxford University Press."

Part II - - - - - - - - Chapter 11

MASTER MECHANICS

IN MANY plants of the largest automotive concerns there are corps of men specially organized to act as couriers and guides for visitors. They show those visitors the iron and steel and coal as it arrives at the docks; they show them the streams of red-hot molten metal; they take them where blue and purple and red flames leap from the mouths of great furnaces; they point out giant cranes and conveyor lines and assembly miracles (black bodies meeting red wheels or red bodies meeting black wheels according to whatever John Jones picked out in the salesroom); they show them master machines that do everything but talk; but they never show them master mechanics.

What possible importance or drama or even interest could there be in a big open office room where men work at rows of desks or at drafting boards, and all one can see are stacks of blueprints or a few cluttered machine parts and some typewriters and telephones?

Even when, all through the night, the usual gloom of that big room is broken and light streams from the long fluorescent bars suspended above those many desks, the plant police, patrolling the adjacent toolroom, give scant thought to what goes on. It is only the men behind the scenes, the men who pull the strings that control the show, who could tell you that certain gaunt and weary men going out of the gate as the early day-shift workers are pouring in, have put in one full day and night, have stuck it straight through twenty-four long hours of driving, persistent concentration.

Before you devotees of a possible six-hour day, you believers in more time for hunting and fishing, skip over this section and say, "That's no career for me," we hasten to tell you that such stretches are exceptional. They are due to unusual times. It may be the pressure of a rush job in cost estimating, when a new model is about to be born. It may be when a new-model automobile has gone out on the road, and in some rare instances one part, perhaps part of the steering equipment, is giving trouble. Those cars already sold must be recalled and made right. And the men of master-mechanics division must sit up nights and replan the manufacturing process where it proved defective in the final test of actual performance. Whatever the emergency, master mechanics must and will rise to it.

The master-mechanics division is responsible in general for transferring the creative designs of the engineering division into detailed ways and means of manufacture. They translate the dreams that have provided designs into plans, into thought-out detail of directions; and they hand on these directions to the men responsible for getting out production. In this process engineering they must also decide upon and order everything that has to do with production equipment.

In the first place, when they study the designs for a new-model automobile or truck or any other product of any company, they may, in some instances, have to go back to the engineering division to report that certain features of the design are impractical to machine. In the next place they must go over the blueprints for the new model and make up cost estimates for all machines, tools, fixtures, gauges, and dies which they have decided should be used to manufacture the product.

At the time when these cost estimates are being rushed out, everyone takes off his coat, no matter what the temperature; the men's desks are stacked high with blueprints; there's an increased tempo in the click of the typewriters; the messengers move faster, and the difference in individual men's tempers becomes apparent as they approach that zero hour when they find out if the grand total for "tooling up" the new model checks to the last penny with the sum total of each man's estimate.

It's an anxious time, and it's a desperately intent time if mistakes have been made and the rechecking on the adding machines has to be speeded up. But after this concentrated business is over and done with, there's a feeling of justifiable pride if the division has maintained its reputation with the management, if it has upheld its high record for speed and accuracy.

The compensation for overtime work at a time like this is not only in the extra money which the company pays. A man may have felt pretty groggy as he reached the detailed prices for each machine, fixture, and gauge on the last few operations of his own particular job. He may have had to call upon a lot of determination to make his mind hold to the task. But when he can feel that he has contributed his best to the whole feat of accomplishment, and that his little part is helping to get the great wheels of industry turning, he generally goes home for a rest with a feeling of satisfaction. It is something only he can feel, and he never has much to say about it.

You have read earlier in this book about the kinds of men who earn the reputation around a plant of being a "real toolmaker" or a "real dieman." This is the same breed in master mechanics. Properly speaking, the toolroom, the die shop, the machine-repair and the tool stores (cribs) are a part of the master-mechanics division, and good men are brought up from experience as toolmakers and diemakers or machine repairmen to serve as tool or die engineers or designers or as trouble and tryout men.

Good men are brought up, and as they become good men in master mechanics they move on to still more challenging work. We are not telling you of the men who become assistants to the general master mechanic, or of the general master mechanic himself, or of the staff master mechanic for a corporation. The story of all it involves to become one of the managers of industry is a story by itself. You'll have to learn a lot about what it takes to be a leader—which means that men have chosen to follow you—before you can understand the inherent make-up of such men.

However, we'll at least hint to you now that leadership in the manufacturing end of industry has meant the evolution of a rare species of being. If he seems to you as long-suffering as Job or as gentle and approachable as a lamb; if he appears as thoughtful and watchful of your feelings as a good doctor; if he toils on as tireless in coaching and boosting you as a good teacher; and if he is the soul of selflessness, laboring like a true scientist toward better and better methods of searching after truth and only truth, let come what may, he is showing the earmarks of one of the higher-ups or "big shots." But don't forget that if you should see him with his back to the wall, hard pressed but still struggling for what he says is right "as God gives him to see the right," he will not only stand his ground but he will also carry himself with the same unruffled serenity, the same balance and poise, that he showed at the moment of his greatest triumph.

So remember to watch and learn from the men who lead. Their modesty will put to shame your cocksureness. And if you see the glint of humor in their very keen eyes when you are "sounding off" as to your new and shiny "school brightness" and you seem to know they're thinking, "What you are speaks so loud I can't hear what you say," don't be too much bothered. Maybe they're thinking back to their own early days when they too took themselves quite seriously, before they were old-timers and grown up.

The most experienced of the master mechanics say that success in their work is like that in other fields—you must have what one of them called an "instinct for practicality." College education and technical knowledge are to be desired but are not the deciding factor in success. A receptive and inquiring mind (not a don't-care, this-is-just-a-job, where-am-I-going-to-step-out-tonight attitude), a willingness to acquire practical knowledge through work in the toolroom or die shop, and a personality that makes you not only respected and admired but also held in affection by your fellow workers—these are the right ingredients for success.

There are certain special qualities you should have acquired by the time you've earned a job in master mechanics. They have to do with a part of the work we haven't described. This whole business of mass production in industry is a matter of coordinated planning, of such detail of organization that it almost defies description. It involves, literally speaking, tons, truckloads, of what is known in the shop as paper work. A goodly share of this paper work comes from the master-mechanics division.

Inevitably, when thousands upon thousands of specific directions as to the methods of machining metal to produce interchangeable parts are involved, there will be many problems to solve. In the planning there will be differences of opinion, varying ideas as to how to do any of a number of things. Always the factors to consider are the most efficient modern machines that can be bought, then the most effective speeds and feeds and use of tools consistent with the material and quality of finish that is necessary.

But one man may say that it will save time and also wear on tools to take two rough cuts and then a finish cut on a certain screw-machine operation; whereas another experienced master mechanic may claim that by using a different tool, perhaps by having a carbide tip, which will stand more punishment than an ordinary steel cutter, only two cuts, rough and finish, are necessary.

We have picked, of course, a very simple example to bring out that there may be differences of opinion, different ideas, among experienced men. Add to this the fact that the experienced foreman and machinist in the shop may have still different methods of doing even a simple turning operation like the one just cited, and you can see the reason for having trouble and tryout men in methods and equipment who are part of the master-mechanics staff. These men might be called tryout men when they are trying new-model plans, trouble men after the production starts and unexpected kinks or "bugs" have developed (foundry trouble—differences in hardness in the casting—is one type of unexpected trouble) and they are always methods and equipment men. The reason they must continually and forever work on methods and equipment is because, no matter how good he is, no one man ever has all the answers. Improvements to increase efficiency are always being sought and from any source, from a machine operator or from a plant manager.

Operation sheets can always be revised to incorporate improvements; fixtures can be altered or redesigned if they prove to be "chip traps." Flexibility and readiness to change their ideas are necessary qualities for men in master mechanics.

So, to sum it all up, if you are to earn and hold a job in this vital division of a plant you must have the thoroughness and sureness that come from practical working knowledge; you must have brains and mechanical know-how without a doubt. However, you must add to that a willingness to take responsibility, serious responsibility, for important decisions; you must have the courage of your convictions;

you must be able to present, defend, and sell your ideas to others; and yet you must not be autocratic or dogmatic or in any way create animosity; you must listen to other people's ideas and cooperate with them.

And if it so happens that not a single one of your own pet opinions prevails in a discussion, you must never hold a grudge. These discussions may wax hot and heavy, full of sound and fury; but watch those same men who are right now condemning, with no pale power of invective, each other's every word and thought; in a few minutes they'll reach a decision and then, you think, they'll be in actual fact at each other's throats—or will one man apologize, perhaps? Well, it's settled and there they go out the door. Yes, it's always that way; they're grinning at each other and planning a hunting trip.

If you are a true master mechanic, you care more for a wise and workable end accomplishment than you care for your own ego. Of course you are bound to get a certain kick out of solving a really knotty problem, but you also get a kick out of having any of the puzzles that both fascinate and challenge you solved, whoever solves it. It's part of the game.

But life is not all play anywhere, even to a man who loves the work he is doing. We told you of the grief—the grease and grime and dirt and heavy oil—that a machinist encounters. There is grief, too, in being a master mechanic.

There are rush times when the men above can't stop to show you the sense behind the many and constantly shifting cost estimates they demand. "Why don't they make up their minds?" you may grumble to yourself. But you are as mum as an oyster and you sit there and do the job, day after day—grief of its own kind. Or there are jobs that almost have you licked, instead of the other way around. One time the metal expands in the cyanide bath—a form of heat-treat

—and the next time it contracts; you machined it the same way; what in the name of all that's holy is the matter? That too can be grief until the moment when all the past experience you've had, everything you've learned about milling a slot in steel and about the effect of cyanide baths, all the unrelated facts that you've gone over and over in your head suddenly crystallize and it dawns on you. "That's it!" you say. "We'll leave it in the cyanide longer and leave more that we can grind off and it'll hold." Then you dash out to the department in the plant, get some parts, machine them, heat-treat them, and get out your micrometer. Every part is identical—you've got it!

So if you catch a master mechanic in some moods he might well say, "A career in this work? It's the most harried and hectic business you could land in"; but even as he explodes about it he's likely to end up with a sort of chuckle, as though he was being amused at his own vehemence, and then say, "Seriously, though, this work is our *life* to those of us who know what it's all about. We wouldn't change it for another spot in industry."

TOOL DESIGNER

I. Duties

In general the duty of a tool designer is to produce on paper ideas of the methods to be used in producing individual parts which are to go into production. When the design is completed it must be detailed with the proper dimensions so that it may be built by the toolroom and, when finished, be able to hold and produce the part as planned. In order to be specific about one particular job, we will suppose that a part print shows the need of a snap gauge (used to measure the diameter of a bar). In that case the tool engineer's duties are as follows:

A. Consider the diameter and the limits—such as a 2 inch diameter with a plus or minus .005 limits (tolerance).
B. Decide the type of snap gauge which is more desirable —for example, a C type or a double-end snap.
C. Draw up gauge on transparent bond paper.
D. Refer the drawing to a checker who checks gauge to the part print and also checks the practicality of the design for the intended job.
E. If necessary, make corrections indicated until the chief tool designer approves the design.

The foregoing example could be greatly elaborated in detail of duty where an involved piece of tool designing is necessary.

A tool designer working on an important jig or fixture must consult the operation sheet and note the operations previous to the one he is working on. This is necessary in order to establish the locating points and the clamping points. The practicality of the use of his design for a fixture on the specified type of machine to be employed is also a primary consideration. Efficiency of operation, involving the loading and unloading time, must be a factor in the design he conceives.

II. Working conditions

Inside work. General large office and designing room.

III. Qualifications

A. Education—Essential: Twelfth-grade graduation or equivalent. In school preparation put emphasis on mathematics and mechanical drawing. A course must be taken in trigonometry.

Desirable: Further educational background. A well-planned college-cooperative program, especially where the individual's talent for designing is recognized and experience is given in industry to consistently develop this talent, will provide excellent background.

B. Training: Those who do not enter industry through a college-cooperative program and who wish to work up

to the master-mechanics division, especially to tool designing, should try to enter an apprentice school requiring a minimum of 4,000 hours, where the courses in shop mathematics and shop theory will include instruction as to kinds and uses of all machines, fixtures, tools, and gauges.

C. Experience: Before acceptance as a qualified tool designer a man should have worked for at least a year as a toolmaker in the plant toolroom in order to learn the how and why of building machine tools.

D. Aptitudes: Ability to visualize, to see the desired tool or fixture in his mind's eye. Creative ability in mechanical drawing. Interest in things mechanical. Ability to judge spatial relationships. Concentration and reasoning ability.

E. Personal: Imagination. A joy in putting down on paper the idea he has formed in his mind. Patience. Painstaking thoroughness in detail work. Ability to adapt to others' ideas and to work cooperatively.

DIE DESIGNER

I. Duties

A. Read and interpret part print.

B. Note the different types of dies to be designed, for example, "draw" type or "blank," etc.

C. For each type of die which must be designed for the part note the press to be used, and from the standard sheet for that particular press determine the size and height of the die. (The type of press will also indicate the bed area, the shut height, the type of fastening in the ram, and the type of pressure—air, spring or none. All of this affects the die design.)

D. Consult stock layout for gauging and scrap cutters. For each type of die there are special problems to be worked out by a designer. There is much more to die designing than "laying down lines that look like a die." A die designer must, as far as he can plan ahead, "design his die to be trouble-free, foolproof and as simple as possible."

II. WORKING CONDITIONS

Inside work. General large office and designing room.

III. QUALIFICATIONS

A. Education—Essential: Twelfth-grade graduation. In school preparation put emphasis on mathematics and mechanical drawing.

Desirable: Further educational background. The college-cooperative program may be exactly the right background, especially for the all-round student; on the other hand, night-school courses in designing, higher mathematics, and mechanic arts may be the answer for another individual.

B. Training: Apprentice training—a minimum of 4,000 hours in an apprentice school—will teach many things a die designer should know. A working knowledge of strength of materials is important.

C. Experience: Sufficient experience in the die shop and in parts of the plant to learn the problems of diemakers is necessary. A knowledge of pattern work is valuable. The length of time it takes for a man to become an experienced die designer depends on himself—his talent, his rate of learning, and his attitude.

D. Aptitudes: Ability to visualize. Ability to judge spatial relations. Concentration. Reasoning ability. Interest in dies and presses and mechanical problems. Creative talent.

E. Personal: Imagination. Versatility. Adaptability. Thoroughness. Accuracy in detail work. Joy in putting down on paper the idea he has formed.

DIE ENGINEER

I. DUTIES

A. Read and interpret a part print of a pressed steel part such as a fender or a body part.

B. Determine from such a print the number of press operations required to make the part.

C. Determine the proper "tip" of those parts that must be thrown out of the "car-line" position. (This tip is the position of the part as it lies in the die in relation to its position on the car.)

D. Estimate the cost of making the patterns and castings for the various dies and the number of man-hours required to build and try out the dies.

E. Write an operation sheet. This sheet gives the whole sequence of press operations, stating the presses to be used and the departments they are in. (These particular operation sheets are used by time study when they establish the labor cost for each operation, by the die shop as an aid in trying out the dies, and by the pressroom to schedule their operations.)

II. WORKING CONDITIONS

Inside work. The men who work in the large open room flanked by individual offices of the general master mechanic and his staff (and located beside the room where the operation sheets are run off on the blueprint machine) have either desks or drawing boards assigned to them. They have stenographers, clerks or messengers available. The room is well ventilated and lighted but there is such an atmosphere of diversified activity that ability to concentrate under a certain pressure of telephones, talking, and moving about is necessary. Trips to productive departments of the plant are made frequently by most of the men in the division.

III. QUALIFICATIONS

A. Education—Essential: At least twelfth-grade graduation or equivalent. In school preparation put emphasis on mathematics and mechanical drawing.

Desirable: Further educational background. If a properly planned industrial training leading to the type of work for which the student has capacity is combined with a college education in a cooperative program, it should provide better human material from which to choose not only die engineers but also other industrial junior executives.

B. Training: An adequate number of years, depending on the individual, working as a diemaker, in order that the die engineer may visualize the diemaker's problems and become familiar with the different types of presses used.

C. Experience: Here again the length of experience in performing a die engineer's duties which will be adequate to produce a "full-fledged" man will depend on the individual rate of learning.

D. Aptitudes: Ability to visualize. (This is known to some die engineers as a "sharp mind's eye." It means to them that a man by looking at the drawing of a part will be able to see in his mind the effect the die will have on the metal when it strikes.) Analytical ability. Ability to think through a problem into all details necessary to get a practical result. Ability to write legibly and to express himself clearly.

E. Personal: Courage. Vision. Patience. Thoroughness. Honesty of standard. Emotional stability. A keen sense of values in weighing essential facts and deciding problems according to both the evidence and the main issue involved.

TOOL ENGINEER

I. DUTIES

A. Read and interpret the print of any part designed for machining.

B. Make requests and suggestions for changes in the engineering design to facilitate production, reduce cost, or improve quality.

C. Set up on paper a series of operations to machine the part according to specifications; in other words, devise the methods by which the product can be fabricated.

D. Estimate the cost of tooling and producing the part.

E. If this estimate is approved for manufacture in the tool engineer's own plant he must then write an operation sheet. (This particular operation sheet shows exactly what machine, tools, and gauges are to be used for each step—operation—in the manufacture of the part.)

F. Make out an authorization request. This is a request for the money required to buy the necessary machinery and tooling.

G. When the money is authorized, make out an order for each machine or tool. Also make out a list of the machines and tools on a follow-up sheet which will be used by the follow-up man, or expediter, in following the progress of the equipment until it is delivered in the plant.

H. Cooperate with methods and equipment men in devising new tooling setups to save time and materials, thereby increasing efficiency. After such improvements are made, the tool engineer incorporates them in the original operation sheet for the part.

I. Whenever increases in schedule are planned or changes in the component part are being considered, the tool engineer must estimate the cost of machinery and tooling necessary to make the contemplated change.
This estimate is considered by the operations committee in determining whether or not the change will be made.

II. WORKING CONDITIONS

Inside. General large office and designing room.

III. QUALIFICATIONS

A. Education—Essential: Twelfth-grade graduation or equivalent. In school preparation put emphasis on mathematics, chemistry, physics, and mechanical drawing.
Desirable: Further educational background. College-cooperative program provides a good way of combining practical industrial education with college theory.

B. Training: Under a college-cooperative program the following desirable type of training will have been secured.

Those who are aspiring to positions in the master-mechanics division who have not been graduated from a college cooperative program should secure training in industry through an apprentice-school course requiring a minimum of 4,000 hours. The course should include shop theory, blueprint reading, shop mathematics, and experience in the school toolroom. Technical knowledge of all machine-shop metals, machinery, and equipment and of shop processes should be included in shop theory.

C. Experience: Before acceptance as a qualified tool engineer a man should have worked for at least a year as a toolmaker and should also have served as a tool trouble man. The more he learns of the organization he works for, its policies and procedures, the more useful he will be as a tool engineer and perhaps in time as a master mechanic.

D. Aptitudes: Ability to judge spatial relationships. Visualization of mechanical wholes and parts. Concentration. Reasoning ability. An inquiring and a receptive mind.

E. Personal: A true engineer's personality—this includes, along with great self-possession and patience, the qualities of a critical, analytical perfectionist.

SAFETY

A MAN, an executive, sitting in a front office—"up in front," they call it in the plant—said a surprising thing about safety the other day. He said, "'Safety' means to me the day my father came home with his finger sawed off. I can still see how the blood spurted out—straight up about a foot—and I guess I'll never forget the downright discouraged look on my mother's face. You see, it meant less food for all of us and we were pretty poor in those days."

Well, we puzzled a bit over that picture; it was too dramatic, we felt, especially for that particular executive. He is noted for his soundness and conservatism; and his modesty of manner, his caution as to statement, almost approach restraint. So we ventured later on to question him a little as to how he remembered the actual spurting of blood a foot into the air, and he gave us in short order the story behind that story. It will show you perhaps why there is a far-reaching significance to the careers of safety men. They work to save costs, they are efficiency men in an organization; but they work, above all, for humanitarian results. Without a doubt the reduction of accidents means the reduction of suffering, hardship, and heartache to women and children who never stepped foot in a factory.

Out of the earliest memories of this man who today sits up in a front office comes a picture of his father being carried into the house on a stretcher. He remembers all about it, although he was only five years old. The doctor didn't set the bones very carefully because, he told the boy's mother, there was no hope. But the boy's father was a most remarkable man; he was of pure Saxon origin, a great blond man over six feet tall and with a perfect physique, "like a Viking," his son says now, as he sits thinking back into the past.

"He wouldn't die. He couldn't give up and leave his family. My father never had a lazy bone in his body and he never had a selfish thought in his head. He was all for his family. He couldn't die; we wouldn't have had anything. Well, he didn't die. But he always limped. Then he lost all the fingers on one hand except his thumb and his little finger. That was in the sawmill. So you see when he came in this last time with that finger gone on the other hand, and he took off the bandage and the blood spurted up and hit the wall of our kitchen, it's no wonder I'll always remember that look on my mother's face. She knew what it meant. We'd suffered before from these times when there was real trouble in the house because my father—great, strong, able and fine man that he was—had been hurt at his work."

It is well that you read this story first so that you may know the responsibility that is yours in terms of human security and happiness if you're going to hope to be a safety man. Great strides have been made in the first-aid care of injured people at the plant itself. State laws provide for compensation. Mutual-aid departments are part of good personnel divisions in big industry, and help is given to families to tide them over. However, you can't be a safety man without knowing that you are in a work where your competence, your eternal vigilance, and your faithfulness in performing your day-by-day duties may be vital to the very life of a human being and to the happiness of those who love him.

And just what will your work be if you ever do get to

WAS IT

be a safety man in an industrial plant? In the first place note that we said "get to be," which is a pretty plain way of showing you that you can't walk into the safety division "cold" and expect to learn the business from the ground up. You must first be a good shopman who knows production processes, the machinery, the equipment, the setup of the plant, and also the policies of the company. In short, a safety man must know the ropes wherever he works. His job is to make and keep the plant from the supports on the chimney stacks down through each shop, office, and room of every size and type to the tunnels underground that carry the pipes, and including the yards and the shipping decks, as safe and free from hazard as modern safety measures and safety devices can make it. To do this he must know the actual state of affairs around a plant and then he must know how to go about it to get things done. He can't be a newcomer and a greenhorn in a company and proceed immediately to get effective changes made through cooperative effort.

He has to know the safety laws both state and federal. He has to know the work of the National Safety Council and profit by their reports and information, and he must send them accurate reports every month of his own accident frequency and severity rates.

He has to know the plant engineer and his staff, the hospital and first-aid staff, the compensation-insurance staff, and especially the supervisors who are handling people. The safety man's work in its broadest sense must be accomplished with the help of all these people plus the very active support of plant management. He holds safety meetings, puts up posters, puts out circulars, sells safety shoes and clothing, checks hazards (work areas, machines, tools, materials), sells safety to individuals everywhere, and does a dozen other things relative to plant safety. And always uppermost in his mind must be not only the care of the individual and the follow-up after an accident, but an eternal concern, study, and searching out of ways to prevent accidents. One safety man we know with shop experience, machine knowledge, and an inventive turn of mind has pioneered many electric controls to make the giant presses of a pressed-steel division more automatic, safe, and foolproof.

The life of a safety man is varied. In the same day he may be reading articles, conferring with experts, and planning the department setup—that is, all the necessary rules and precautions—to handle a new production job involving the use of the highly inflammable metal magnesium, and then find himself, in a matter of a few minutes, riding to the hospital with a young apprentice lad who has had his arm mangled by a drill press.

We are recalling actual occurrences in the life of a safety man as we write this. And we can think of no better way to tell you the kind of person you'll have to be to qualify for safety work than to report the conversation with that man when he had returned from his hospital trip.

"Is Chuck going to be all right?" we asked him.

"A kid like that is going to be *made* all right. If they can't do it down there we'll get some top man who can. I sound kind of steamed up about just one kid, don't I? You see, it was his fault all right, running his press with a sleeve rolled down. But it seems the boy was getting off early, as a special reward to him for trying so hard in the apprentice school. He was a country lad, rather new to the place, and he hadn't been able to get out and ride his horse, what with his new homework and chores; but the boss was giving him a chance to get home early because of his record and so on, and he was going to ride his horse. He quit work, washed his hands, put on his sweater and his Western high-heeled riding boots, and then he saw he had five or six more minutes to put in. So instead of loafing along toward the time clock the way most of us might, he figured he'd pitch in and drill some more pieces. He was excited, I suppose, and forgot the rule about rolling up his sleeves.

"When his sweater caught in the drill, those high heels helped to throw him off balance. Anyway, he got pretty badly mauled. Fractured shoulder is the worst, I guess, but it was pretty bloody too; it took stitches and a lot of bandaging. Well, going down there in the ambulance I crawled up to the head of the stretcher and I said to him, 'How are you doing?' He was as white as the sheet they'd put over him, and the doc told me later he must have borne a lot of pain; but he says right off, 'O.K.' And then that little kid, who'd been caught right up and whirled twice and a half around by the big spindle, he looked up at me and smiled and he said, 'My horse will miss me.' It kind of got me. With all I've seen of human suffering—an old hand like me—still, I tell you, it kind of got me."

SAFETY

I. Duties

A. Understand all plant machinery and equipment.
In an automotive plant employing about 30,000 people where there is everything necessary to produce a finished automobile out of raw materials—a foundry, pressed-steel department, die shop, heat-treat, and every kind of productive department and machine shop—this is no small order.

B. Keep informed in regard to all new safety knowledge. This involves active participation in the work of the National Safety Council. A study of the published findings of research men. Community contacts permitting observation and study of others' experiences regarding protective controls and precautionary measures for newly introduced materials—for example, magnesium and plastic. Keeping up to the times with modern educational methods; not blind following but intelligent appraisal of new proposals.

C. Make periodic checks of specially hazardous areas; for example, the condition of the supports on chimney stacks must be inspected.

D. Make regular checks on good plant housekeeping. This includes inspection of hazards in work areas—check illumination, ventilation, etc. Material handling—weight, poisonous character, explosiveness, etc. Machines—belts, improperly guarded gears, etc. Clothing—improper shoes, flowing neckties, etc.

E. Plan and conduct publicity and educational programs. This includes a perpetual advertising campaign through posters and bulletins and the publishing of monthly safety records showing the department's standing.

Statistics showing frequency and severity of accidents are compiled for each plant according to the National Safety Council's standards.

Also includes man-to-man instruction and friendly admonition; the selling of safety to workers and supervisors to promote safe habits of thinking and reacting.

F. Follow-up of all injuries other than the most minor ones. This involves the careful investigation of all material and personal causes of the accidents; the taking of necessary statements from witnesses; the check of the hospital report and the supervisor's report; and the writing of his own detailed report giving all facts and fixing responsibility.

The final piece of follow-up work after the accident is the most important duty of all. It is the correction of a contributory cause where preventive measures can be taken to avoid future injury.

II. WORKING CONDITIONS

Covers all conditions to be found in a plant, outside as well as inside; from the tunnels where the pipes run underneath the plant, to the roof of every building; from the foundry where a man is pouring metal, to the front office where a woman is operating a comptometer. A safety man works everywhere, for the work of accident prevention is not restricted to the shop.

III. QUALIFICATIONS

A. Education—Essential: Twelfth grade. Further technical education through specialized safety engineering courses is necessary to keep pace with modern changes in method. College background is desirable in a broader educational sense but not from a technical consideration.

B. Training: Five years of varied shop experience.

C. Experience: Another five years of actual work in safety engineering before a man can be considered fully experienced.

D. Physical: Good health. Good eyesight and good hearing. Energy. Stamina.

E. Aptitudes: Mechanical aptitude. A safety man does not need the high degree of mechanical ability that a skilled craftsman such as a toolmaker needs. However, he must possess definite capacity for understanding things mechanical. He must have a leaning toward machinery, a liking for it, and best of all, he should have inventive imagination—not merely to design safety gadgets but to conceive and develop throughout the plant mechanical improvements and innovations that result in accident prevention on a broad scale.

F. Personal friendliness: Must be well informed and tactful; must use diplomacy, persuasiveness, ingenuity, and be adaptable. Must have the ability to give and secure cooperation throughout the plant. Must be able to handle difficult problem people. Must have tenacity to stick at difficult-problem situations. Must be enthusiastic about helping people to help themselves to live safe and sane lives through acquiring a certain amount of self-discipline.

SUGGESTED READING: "Careers in Safety," by Herbert J. Stack, Charles C. Hawkins, and Walter A. Cutter, published by Funk & Wagnalls Company, New York.

TIME STUDY

IN A little town in Massachusetts there's an old farmhouse, the built-on, early-American type with a white clapboard house and woodsheds and big barn all rambling together like the red rambler roses that spread all over the place. It's called the Half Way House. Before the great automotive industry had given to men all sorts and sizes of trucks and motors, there was an express route running from Plymouth to Boston. It was an outfit consisting of eight horses and two express wagons. And here at the Half Way House they changed horses. Also the south-bound driver and the north-bound driver rested, ate their supper, and spent the night. The whiff of sea air across the marshes, the scent of pine trees from the forest, and on a stormy night the beating of the waves against a rocky shore—all these things have always been and always will be at the Half Way House. But the charm, the true nature of the place, has come from its people; the same family—"real good" New England innkeepers, we'd call them—have made wayside journeyers welcome, warm, well fed, and content for nine generations.

Now before you, who want to know about time study, tell us that we are way off the beam, or else ask us if they by chance have a name band at this joint, and if so, you might stop in on your next helicopter tour—we'll tell you just why we begin a factual treatise on the time-study division with what *you* might call a plug for a hotel.

To our way of thinking, the men in industry who are time-study men have reached a spot comparable in many ways to the Half Way House. For one thing, it is a point about midway between the most elementary beginning jobs in industry and the top-management or executive positions; it has a half-and-half aspect, inasmuch as the time-study man spends about half his time in an office and half his time in the shop. But, above all, the division, to us, is like the Half Way House because it is the human element, the kind of men who do time-study work in a plant, which really *makes* the division, just as that fine old family with their traditions of hospitality and their warmth of personality really make the house.

It is not a hard nor complicated task to master the techniques of time study. Under the outline which follows this you will find that the first duty of a time-study man reads: "To observe, study, and establish the labor cost on each operation for each productive job being performed throughout the plant." And then there is an explanatory note to show that the much publicized business of standing beside a machine operator with a stop watch and a form sheet on which the time-study man records the exact split second of time that each element of the operation consumes is a small part of the performance of this duty. For that note reads, "This involves the very essence of time-study work, since a process of leveling is used in order to so judge an individual worker that the proper rate for an average or normal man is set up." To so judge—this means that a time-study man must know a great deal about people, and to know people he must have liked them and they must have liked him and trusted him.

All of this stressing of the humanitarian side of time-study work must by no means be interpreted as meaning that there is a sort of sob-sister, sentimental, or apple-polishing nature to the art of handling men. It requires the greatest strength

of conviction, courage to stand his ground, and capacity for balanced, sound appraisal based on facts and only facts, to be recognized as an able time-study man. Executive ability and integrity of action are primary concerns. But when a time-study man goes out to a department to time a job, or when he estimates how many men are needed to handle a big contract, or when he decides what occupational classification a certain kind or type of work belongs in, he is making a decision based on his scientific knowledge and judgment of what people can and should do to earn their wages. And this is a vital matter to thousands of men and women.

If he is the kind of man who cannot get others to believe in him and work with him; if he is the kind who says one thing and means another; if he is the kind who doesn't know what he's about; if he's a four-flusher; it will be the simplest thing in the world for men to detect his lacks and make a monkey out of him and his work. A time-study man must know the proper setup for a machine, the speeds and feeds, according to the material being machined. He must know the most efficient method of performing the job—or operations—he is studying.

For example, every waste movement consumes time. A man who thoughtlessly stoops to pick up his material from a box on the floor when he could have it on a small table close to his left hand and perhaps pick up the new piece with one hand while laying down the piece he has just gauged with the other hand, is losing only a few seconds after each piece is machined, but in the course of a week he may have used up an hour.

The time-study man must know how to eliminate all waste motion, and in place of awkward, jerky, uncoordinated performance he must build up a smooth, easy, rhythmic flow that is conducive to steadiness and quality of output. And as he holds the watch on a man he must know, even though he never set eyes on him before, whether he is at that moment stalling, or doing his best, or putting on a show-off burst of speed. He must in this process of leveling give that utterly strange machine operator a rating on skill, effort, and consistency, marking him above or below an average man's proper performance. Therefore he must so well visualize the average proper performance of each operation he times that he can make fair and accurate comparisons. To do this it is obvious that a time-study man must know the shop. He must know materials, machines, methods, and he must know men.

Time study has great significance in the smooth operation of that complicated machinery of organization which makes mass production possible. And it is mass production that cuts the costs of products so that our high-standard American way of living has become a model for the world. In order that you may better appreciate this significance, we think it well to quote the following, written by the head of a time-study department.

"What we call 'efficiency' in the industrial world is the securing of a higher percentage of results by the application of the scientific method. As a matter of history, the principle of efficiency was first proposed by a man called Charles Babbage nearly a century ago. Babbage found by visiting many factories that manufacturers were wholly unscientific, that most of their work was guesswork. He discovered that they relied upon old opinions instead of investigation and improvement.

"As a result of his investigation and study, he laid down several fundamental laws of efficiency which constitute the foundation of time study.

"He was the first to point out that personal experience is not enough in industry. It depends on a knowledge of what has been done—it means facing the past, not the future.

It is necessary up to a point, but experience must walk hand in hand with research and development."

It is well for you to consider, as you read of this type of work, that the time-study experts who have so far developed in their profession that they can from previous findings and past experience estimate the total labor cost of a brand-new product and arrive at a figure within close range of perfection, are men whose proven dollars-and-cents value to industry is self-evident.

In the beginning of this write-up, there is an allusion to the fact that time-study men are "half-way" career men, inasmuch as they are midway between unskilled laborers, who perhaps shovel sand in the foundry, and the men who set the policies and hold executive control over all phases of a great industry. It is true that many men have come from the shop into time-study work and many men have gone on from time study to managerial functions. However, the man who makes for himself a complete career—a course of life—in which his learning and working hours are built around the study of motion, method, efficiency, and time in the lives of human beings, has built for himself a career that is not only sound, secure, and stable, but is also a source of expanding growth, challenge, and achievement.

TIME STUDY

I. Duties
  A. To observe, study, and establish the labor cost on each operation for each productive job being performed throughout the plant. This involves the very essence of time study, for a process of leveling is used in order to so judge an individual worker that the proper rate for an average normal man is set up.
  B. To analyze operations and studies for improvement of methods and processes where changes in machines, fix-

tures, and other equipment would mean increased efficiency—less motion, less time, less money—and to suggest these improvements to the management for consideration.

C. To study and establish man-power requirements for each department based on production schedules. This established requirement must consider the proper number of men necessary for the different kinds and types of work.

D. To estimate for new products to be manufactured the rates of production and rates of labor costs. This is one factor to be considered before the selling price of the new product—an automobile or a marine motor or a truck—can be decided upon. The advanced estimate becomes necessary as soon as the first specifications for the new product are being drawn up. A check on the accuracy of the estimate can be made later when production is under way.

As a result of the responsibility for determining labor rates of production, man-power requirements, and labor occupational classifications (rate of pay for all types or classes of workers), it is inevitable that the duties of the time-study division will include a consideration of any grievances on the part of labor which may involve these matters. Substantiation of the fundamental facts—the actual time plus all proper allowances such as personal fatigue, etc.—is always the pertinent factor in a consideration of the fairness and reasonableness of the production standard which has been set. The time-study division, having gathered these basic facts, is in a position to review and explain to the labor-relations division a standard which may have seemed arbitrary to labor but when interpreted in detail should prove conclusively that unbiased thought and concern has been given in equal measure to the interests of both the worker and the management.

II. WORKING CONDITIONS

Inside work. Time is generally divided by all time-study men, except the head of a department and his assistant, between desk work in an office and the carrying out of time-study functions in the shop itself.

A. Education—Essential: At least twelfth grade or equivalent. In school preparation put emphasis on a general cultural course as well as technical subjects. In addition to the high-school course further technical training is helpful.

Desirable: College graduation. A college degree may be obtained through enrolling in a college-cooperative program (half time is spent in the technical or engineering school of a university and half time in gaining industrial experience).

B. Training: Adequate practical shop experience. This will vary with individuals according to their mechanical aptitudes.

C. Experience: It is necessary to keep in mind that the availability of time-study men (operation of the law of supply and demand) is the deciding factor both in the selection of applicants and in the standards that are maintained. However, it is probable that a man who has the desirable background will be considered experienced after one year of interested application in the time-study division. An average man will need two years to attain the same rank.

D. Aptitudes: Analytical ability; this is an outstanding asset to a time-study man. Interest in industrial equipment, machinery, and tools. Scientific habit of thought.

E. Personal: A liking for human beings which is evident to them. A consistent fairness and honesty in dealing with every man which earns his confidence and support. Vision. Imagination. Balanced judgment. Emotional maturity. Adaptability and humor, these last two above all.

PLANNING

SURE I worked in planning. I worked there for fifteen years. Boy, that *was* a job! Outside follow-up man. But I couldn't take it any more, not when I got past sixty. It's a great life for a young man, though; excitement—out on the road—you never knew when and you never knew where nor for how long; skipping all over God's green earth to put the heat on some vendor.

"And you had to stay with it; you'd hate to come back unless you were bringing the bacon, principally because you knew how much it meant. The planning department, I've always figured, is a mighty important place to work—they keep the material flowing that keeps the works running; at least that's part of their job. I knew what it was all about, for I'd been a shopman most of my life. Of course some fellows go in there as young men and work up from clerks. You can do that; but a follow-up man is better off if he knows the shop. You're better off almost anywhere in this business if you know the mechanical end.

"I know there are some of those higher-ups in planning who never ran a machine or developed a die or did a lick of real work out in the shop and yet they've made good. One man who worked out the best system in the industry for an up-to-the-minute inventory, he's a regular business genius. And the men who planned the salvaging and reclamation, I know they learned it and figured out better methods as they went along and they're still figuring. But every one of those fellows had to get his foundation, had to have a good working knowledge of shop work whether or not he ever ran a machine; some got it one way and some another.

"It's true you can start as a stock chaser, but that's in the shop. One fellow, one of the very finest in a big company, started as a secretary to the works manager. That was when he began, thirty years ago. But they kept sending him out in the shop to learn; he'd watch and ask questions and they'd coach him.

"Once in a while they try out some college fellows in planning but most of 'em never saw the inside of any college. It boils right down to this: Have you or haven't you what it takes? Now I could be a follow-up man all right—when they sent me out I'd come back with the goods and they knew it.

"I remember one night they sent me up to Jamestown, N. Y., on an engineering change on the instrument panel, changing the cutout for instrument assembly. This meant a new blanking die. When I reached the plant, which was on the night before a holiday, there was no steel on hand to make up blanking dies and no plant that had a forge shop. The instrument panels had to be shipped the next day in order to start up the assembly line the morning after. I knew damned well I couldn't sit around and do nothing. So I took a look and I saw some chunks of cast iron—some blocks. Well, I took one part of the die and the foreman the other part and we worked on the shaper all night. By the time the sun came up we'd finished the die and we were tired. But we hopped to it and blanked 700 of these parts, grained them, loaded them on a truck, drove to Buffalo, had them loaded on an express train, and they reached our plant ready for production the following morning.

"I remember I slept most of the way home, but I slept the sleep of the just. The boss got quite a kick out of that. As I say—without its being any credit to me, for everybody has his good and his bad points—I had what it took to be a follow-up man; but I couldn't have been a schedule man or an engineering-specifications man, and I didn't know enough to be a planning supervisor or a superintendent of planning—far from it.

"You talk to the boss himself—he's a lot younger than I am but he's the head—and he'll tell you what it's all about in the planning division; and believe me, he knows. Most of us around here, we do what we're told, the best way we can, but the superintendent—the boss, we call him—he's still a pioneer; and that's the spirit we need today with these young fellows coming in, the same spirit he still has, of growth and adventure. We're not finished in industry; the planning isn't all done.

"Old-timers like me, we like to see a man come in here with some get-up-and-get to him, some real gumption, not a fellow who's a smart aleck, who already knows it all—we don't want him. But we do want the one who wants to learn, has a kind of inquiring mind and then has that extra ounce of won't-be-stumped in him—something I always had, I think. And then we want that special kind of man with what I guess you educated folks call vision, and with brains to put it over. For that kind I just sum it up by saying we need more like the boss. You go talk to him."

We talked to the boss. After five minutes we knew he was a variation of the leader type we had met in master mechanics; he had more quick, brilliant, restless energy, more creative ability applied to business systems, devices and plans, and he had more concern with thrift in a constructive way. He was a pioneer who dealt with puzzles—solved the riddle, worked out every fine detail, and then expected high standards of performance from every individual. He worked as a perfectionist who kept seeking to do *better* everything that he himself did; and he expected others to show that same

zeal. After two hours we were sure we had been right in our intuitive impression. But we had also learned enough of the complexity of planning to know that a complete book should be written about it, and we regret that we can only hit the high spots in this sketch.

Planning is the synchronization of materials and action to produce a desired product. With that generalization out of the way, suppose we come down to cases. Let's use the automobile industry for an example: the head of sales for a corporation, having seen the new model and considered the market conditions, says, "I think we'll *sell* so many thousand cars." The head of production looks over his plant facilities and the general situation and says, "We can *make* so many thousand." They arrive at a figure; an over-all production schedule is drawn up; the central estimating group, master-mechanics men, say what parts should be bought from vendors and which plants should furnish what. Then along comes the planning job for each plant. They must requisition the materials from purchasing. They must make up detailed production schedules and plan out delivery dates of material to meet those schedules; then they must coordinate the flow of raw materials and vendors' parts so that they get to proper departments—first for machining, then for assembling, and finally for shipment.

All this scheduling, expediting, or follow-up work to get the cars out to meet the sales requirements can be brought down to a specific problem which, as a would-be worker in planning, you may see if you could solve. Your job is this: you must so time the bringing in of all raw material and all purchased parts, and you must so schedule the production throughout the plant, that on a previously set day a young man from Colorado can fly to the plant and without delay drive off in the convertible coupe with the black body, red wheels, tan top, special horn, two cigarette lighters

—the exact car that he and his fiancée ordered from a catalogue in the Denver dealer's office.

There is one particular high spot of the work in planning which is concerned with thrift in industry. It is the work of salvage and reclamation. Imagine yourself visiting a great incinerator building to which electric trucks are hauling skid boxes full of chips, classified according to metal analysis, to be shipped in car lots to a refinery; all those men around the place who are sorting out paper—the redeemable to be sold—will soon shovel the refuse from every plant wastebasket into that big open door of the roaring incinerator; and as the hot flames shoot up, remember that their fury is being turned into steam to heat the buildings. Nothing is wasted.

Move on from this building to others and you'll see the most mixed-up collection of junk—hopeless confusion to your eyes—being sorted into fifty or more kinds of metal to be sold to refineries. You'll see rubber and rags as well as paper and metal being salvaged and sorted into barrels for sale.

Then visit the place where great quantities of steel remnants from the giant presses are being pounded, jammed, and compressed by a strange machine like a battering-ram until they come out in a neat-looking 90-pound bale which slides on to an escalator and moves silently up into the air and out across the yards until it reaches the foundry.

Walk over to the foundry dock, where all the incoming iron and products from the mines are waiting to be fed into the blazing furnace of the cupola, and you'll see not only that same bale of steel but hundreds like it, together with tons of metal of all sizes and kinds, being lifted by a tremendous magnet and gently lowered to the platform, where they too will be fed into the cupola. And thus it is that the metal which once was a piece of scrap starts all over again as a useful unit in the process of production.

Another high spot in planning, to which our old-timer friend referred, is the "perpetual" inventory, which means that plant supervisors can have a report on their desks every morning to tell them where they stand. Automatic business machines make this speed in maintaining records possible. By means of the key punch and accounting machines, the men in planning can follow the progress of each car from start to finish. One thousand cards, each representing one car and punched to show the specifications on each customer's order, are fed into a machine. As each card reaches the proper slot it falls down into a compartment and its fall is registered on a counter. When all the cards have gone through there are totals ready, showing each type or model or whatever grouping this human robot was set up to determine.

This is the best method known for taking the curse out of the eternal thumbing and sorting and posting and listing that made so much drudgery for so many people for such a long time.

This and the other pioneer work accomplished in planning have resulted in greatly increased efficiency in big industry; the immediate result is a cut in the cost of a product; the next result is an increased market or number of buyers; and then comes a step up in production which is followed by expanding employment. So whenever improvements are made technically in industry, the final result is that more workers can be hired and our American standard of living can go higher.

The men in the planning department are often advanced to more responsible work in purchasing. However, if they go on to the supervisory and administrative jobs in their own department, they are assured of careers in a work without which big industry would surely bog down.

The planning department is like the circulatory system of the whole industrial body. If the flow of blood stops, life stops. If the flow of material stops, production stops.

There is little question that any man who is a part of the particular group controlling such a vital function is bound to feel a sense not only of responsibility but also of adventure and achievement. And if he becomes a top man in planning he may well realize—although he'll not thank you for telling him so—that he is one of those who, by their vision in creating better systems, their brains in solving puzzles of tie-up or timing, and their do-or-die energy in delivering the goods "come hell or high water," have made our American industry one of the wonders of the modern world.

SCHEDULE AND FOLLOW-UP MAN

I. Duties

Supervision in planning is responsible for developing the master-building and shipping schedules for each plant.

A. From the material record card which is set up by the engineering-specifications man and shows requirements per finished unit—in conjunction with a master building schedule of finished units—and considering the amount of material necessary to fill the production system plus an additional quantity to be held in stock as a safety measure, and an allowance for scrap, calculate the quantity of material to be either purchased or made monthly and the total quantity of pieces of each part authorized.

B. For purchased parts write purchase requisition for difference between quantity already purchased and total quantity of pieces at present authorized.

C. On return of copy of purchase order make out a shipping schedule and send it to the vendor, giving him exact time to ship (daily, weekly, monthly) and exact amount.

D. Send out to proper departments for manufactured parts a production schedule showing exact time and amounts to be manufactured.

E. Follow up either the vendor's or the shop schedule to see that parts are being either shipped or made in accordance with the schedule.

F. Notify vendors of impending engineering changes and advise as to when change should be made effective. Follow up this change. Also follow the same procedure for cancellations.

The follow-up man or expediter who works entirely on the outside with vendors is the type of worker represented by the old-timer whose words start off the sketch about planning.

II. WORKING CONDITIONS

Inside. General large-office conditions.

III. QUALIFICATIONS

A. Education: It is desirable for a man to have at least a high-school education, and possibly a general college education is of advantage inasmuch as it will help toward his advancement. However, if a man is able to write a good legible hand, read with real comprehension, has a good working knowledge of arithmetic and has a high degree of native intelligence, he will be able to qualify.

B and C. Training and Experience: In general, approximately six months of training with an experienced schedule and follow-up man is sufficient for a man to handle the job competently and be considered experienced.

D. Personal Traits: Drive. Persuasiveness. Ingenuity. Persistence. Steadiness. Patience and accuracy in detail work. Cooperation. Adaptability. Tact. Loyalty.

ENGINEERING-SPECIFICATIONS MAN

I. Duties

A. Upon receipt of engineering blueprints and specifications, transfer information to material record card in terms of quantities required, type of material, and where necessary the size and chemical analysis of material. (For use made of this card refer to duties of schedule and follow-up man.)

To perform this duty a man must:

1. Read and interpret engineering releases.
2. Read and interpret engineering changes.
3. Read and interpret blueprints as far as securing necessary specific information is concerned.

B. Check proper usage of materials in production division. (For example, one gasket may be specified while two are being used.)

C. Assist supervision in establishing the effective point in production at which the incorporation of changes can best be made. (This judgment involves consideration of time required to get tools and materials, and in some cases involves obsolescence.)

D. Keep the service division fully advised concerning changes in design of car parts so that proper replacement can be made whenever repairs become necessary.

II. Working conditions

Inside. General large-office conditions.

III. Qualifications

A. Education: It is desirable for a man to have at least a high-school education, and possibly a general college education is of advantage inasmuch as it will help toward his advancement. However, if a man is able to write a good legible hand, read with real comprehension, has a good working knowledge of arithmetic, and has a high degree of native intelligence, he will be able to qualify.

B. Training: Preferably six months to a year, depending on the individual.

C. Experience: It takes about a year for a man to become an experienced engineering specifications man.

D. Personal Traits: Accuracy. Conscientiousness in doing thorough work and in keeping work up to date. Persistence and resourcefulness in securing authentic information. As in any work, a well-adjusted, enthusiastic, and cooperative type of person is to be desired.

PURCHASING

THE purchasing department reaches so far inside industry—into every nook and cranny, and so far outside industry—into every one of the four corners of the round earth, that its very vastness of scope and its minuteness of detail stagger the imagination.

For big industry buys not only so much, so many things, but so many kinds of things that one's mind must jump from the purchase of a giant locomotive for use on the company railroad to a fine needle for a shop sewing machine; from a thumbtack or a paper clip to an electric billboard which sales will use for advertising. The men in the shops and offices need drinking fountains, the executives need thermos jugs, and both articles require ice. Doctors need stethoscopes, thermometers, and tongue depressors. The plant police need revolvers and visitors' badges and master keys. The cafeteria needs a side of beef and a head of lettuce. The foundry needs pig iron. The toolroom needs imported precision tools. The diamond crib needs diamonds.

And we haven't yet thought of the main essentials—the thousands upon thousands of mammoth machines and tools, the tons and tons of metal, the rubber, the coal, the furniture, the paper and ink, the oil and grease, the innumerable, indescribable variety of material things which must be procured by purchasing if the wheels of industry are to turn and men, through machines, are to manufacture products.

It is a fascinating, intriguing game to let one's fancy carry him from the raw materials deep down in the earth to the energy of radio and electronics high in the heavens, all of which is involved in the work of purchasing.

If you have ever thought of the work of this department in industry as a prosaic detailing of orders for material, a review of competitive bids, and then the inevitable selection of the lowest-priced vendor and the writing of a purchase order, you have had a myopic and painfully clouded vision.

According to a statement from one of the big corporations, the purchasing department can better be defined as a procurement department. Its most important function is the selection of proper sources, with the ability to manufacture and supply materials or services in accordance with the specifications of the corporation engineers or specialists, and the ability to meet the corporation's specified delivery requirements at a price which must be satisfactory, although secondary in its importance.

In order to carry out this function a well-coordinated team or unit has been planned and built up by this particular company.

In describing their special team we will start with the group of clerks who receive the purchase requisitions, those basic pieces of paper from which all the work of the department will stem. These clerks must possess the qualifications to properly identify materials and commodities in order to interpret the requirement and make the assignment for purchase to the buyer involved.

The men in the next group are known as specialists. It is a corps of men, often recruited directly from the shop or other departments, whose function it is to seek out sources for new commodities, to inspect vendors' plants and their methods of operation, and to interview vendors as potential sources of supply. The activities of this group are properly recorded for the ready reference of buyers.

Then there is a group on this over-all purchasing team known as trouble men. Their function is literally "shooting" trouble in the plant of some vendor, trouble which is affecting deliveries to the buyer and may jeopardize his production. These trouble men must qualify, through previous industrial experience and through inherent ability, for the job of quickly ferreting out the cause of difficulty in the vendor's plant, and, with the least possible delay, being able to "hop to it" and take corrective action.

Another division in purchasing is the statistical and record group, consisting of both men and women. Their name shows the nature of their work but not its complexity nor scope. For they gather facts and figures ranging from a forecast of the anticipated future requirements of a commodity to an elaborate study dealing with commodity markets, prices, and trends.

None of these groups does any buying. But their work all contributes to the activities of the buyers. And the buyers are a group with differing degrees of school background, knowledge of materials, industrial experience, and proven ability. They are assigned to the buying of certain classifications of items according to their qualifications. They may be, for example, buyers of rubber commodities, buyers of major items, buyers of minor items. And in starting in on their buying experience in any of these classifications they will be known as junior buyers.

It is possible, but not a very common thing, for a young man to start with clerical work in purchasing and work up to a buyer's status. One man who is now a general purchasing agent started with his department as a stenographer. And many buyers in big industry have gained experience as assistants in small companies.

However, in the majority of cases men have been selected from various other departments in industry to be trained as buyers, provided they have not only gained valuable knowledge and experience but have also shown outstanding qualities which recommend them for buying. We shall elaborate on this point later on, when we discuss what it takes to do the more responsible work in purchasing. Departments from which men have been promoted to buying are planning, engineering, plant engineering, and master mechanics.

The last of the component groups which make up the purchasing department is the group at the top. These men are the head himself—the director of purchases—and the general purchasing agent. They include also the men who work on the staffs of these two men as staff assistants, plant-purchasing resident representatives, buying-group supervisors, special-assignment men, and others whose duties and responsibilities are chiefly of a supervisory and administrative nature.

Since the very complexity and immensity of the total function of purchasing keeps us from giving you more than a few high-light impressions of the whole panoramic picture, we are forced to leave much to your imagination. But if you are likely to be one of those few who can achieve leadership in purchasing, you will need among your natural talents that very thing—imagination. For you must project yourself into the shoes of the man in your own company who needs a certain purchase, let us say a malleable casting, and who knows why he needs the casting as specified, how it is to be used and when it is needed, and you must understand the reason behind these facts. And then you must project yourself into the shoes of the vendor from whom you buy that malleable casting, and know the problems he must solve in his foundry before he can deliver on time and in the right condition just the kind of casting called for.

If there are any problems of metallurgy involved, your imagination will help you in seeing your own need for more knowledge of the chemical changes in metal. If you can picture the part that is played by those men responsible for the proper combinations of elements in the successful output of the foundry, you may find yourself studying the composition of metals, analytic chemistry, and the experimental methods of metallurgists right on the scene of action.

We can't say how far into the understanding of shop and foundry processes a keen buyer may find himself not merely required by need but challenged by interest and the romance of the whole subject to delve. But we can tell you of one young fellow who was thrust into the job of buyer without sufficient knowledge and who seemed rather good—almost precocious—until one day he suavely defended a foundry vendor, a certain Mr. Jones. Mr. Jones was not coming through with malleable castings as specified. "I think we should be considerate, gentlemen," he said. "Mr. Jones is having trouble with his comparator."

We hope that even you who are picking up scattered industrial information from this book to help guide you toward a choice of vocation know that the young buyer had made a startling error; for a comparator is an inspection instrument, far removed from the foundry's making of a malleable casting.

We stated earlier in this write-up that we would elaborate a bit on those personal traits which are likely to cause a man to be noted and spoken of as a likely candidate for promotion to responsible work in purchasing.

The first and all-essential requisite is honesty. If he could possibly, even in insidious and devious ways, be bribed into an unfair favoritism, he is "out" as a buyer. He must also have such a knowledge of human nature that he sees through the plausible "apple polisher" who tries to play up to his own personal likes in order to get him in a mellow mood where he will be influenced to like the salesman and therefore buy his goods.

A buyer must have balance and poise as well as intelligence.

He mustn't, as one purchasing agent in industry put it, "have ice water in his veins," and he surely must be farsighted enough not to try to squeeze every last drop of blood from a vendor or try to buy too close when it is a buyers' market. If he does, retaliation will follow when it is a sellers' market. A reasonable give-and-take with his vendors will produce mutual respect for fairness and an established friendly confidence.

A buyer must surely make friends but he must always be objective in his thinking. He must analyze every angle of a situation, examine and weigh every fact he can find to help him solve the puzzles and problems of purchasing.

Always in buying he must work out the problem of getting the right thing at the right time from the right vendor in order to keep the line going, which will be his first thought. And then he must be so keenly aware of what a fair price should be, considering the vendor's efficiency breakdown of costs as well as the market conditions, that he will arrive at the right price commensurate with assurance of reliable quality and service.

Mutual trust is the keynote to successful relationships between vendors and the purchasing department. A particular corporation earns part of its reputation through its decent treatment of vendors. Therefore the personality of a buyer must be that of a diplomat. He is a major part of that channel of good will which must flow between corporations and their sources of supply, including even the smallest manufacturer. Big industry needs little industry and vice versa.

Sometimes big industry is erroneously thought of as squeezing out little business or as being so hard-boiled in their demands upon vendors that the poor victims can never get ahead or realize a just profit. This idea is sheer nonsense. Big corporations want their vendors to succeed, and they want to deal with men of character on whom they can rely for honest, steady, efficient service over long years of mutual trust. As a matter of fact, a big purchasing department has been known to seek the aid of the financial and mechanical departments to give concrete support to help build up a young vendor in whose personality, capability and character it has confidence.

The men in purchasing buy wisely. Their judgment is sound, and to put it plainly, they know their stuff. They don't neglect the pennies or countenance wasteful extravagance. However, they are never penny-wise and pound-foolish. For the men at the top in purchasing, their trainees and their experienced old hands, are men who can speak with authority, whatever the special province of their work.

Purchasing men who are noted around a company for their achievements are also men of vision. And they are outstanding men of character. If you ever climb up to a responsible job in purchasing you'll have found some of the romance, the adventure, and the excitement in industry. And you'll have found the fascination in working out involved and high-pressure problems of procurement.

There's one other thing. In looking ahead you might, perhaps, suppose that after about thirty years you could sit back a bit and take satisfaction in all that you had seen and learned and done. But that day hardly ever comes to a purchasing man. And that's why his life is such a sound source of happiness—that is, if he has grown up to being really good in his work. You see he's too busy to stop and congratulate himself on his career.

He's no narrow-minded, hidebound old drudge who is feeling weighed down by a dreary round of irksome duties. He's a man who "can't find time enough in any one day to do all I want to do to lick all these problems," but who shows in his very look the delight, the drama, and the zest that his wholehearted attack on his vital part in the great, dynamic, industrial scene still means to him every busy day.

PLANT ENGINEERING

WE HAVE proceeded from the ground up in this book. In a career way, we began with an unskilled apprentice and worked our way up to executives, to superintendents, to directors. In a material way we began in the ground itself with the iron that goes to the foundry. We wrote about patterns, castings, dies, tools, machines—machines for the shop and business machines for the offices. And now we come to the layout of all these machines, to the equipment necessary in a building, and to the building itself.

In past years the system used was to first purchase a piece of property, then design the building to suit the property, then install the machine tools and equipment the best way possible in the building. This practice was successful when products were produced by more or less the toolroom method. Today we have mass production, which means that plants, machines, and equipment had to be revolutionized to produce in mass quantity. The old toolroom method was discarded and the production method incorporated, which meant, first, the layout of machine tools and equipment; second, the designing of the building; and last, the acquiring of the property.

A corporation can have the finest of machine tools and equipment, yet if the layout is not properly made, efficient production will not be achieved. In short, no plant is any better than the plant layout. The responsibility of this layout is the plant engineer's.

The designing of the buildings is also the function of the plant engineer, both architecturally and mechanically. This includes heating, sanitation, ventilation, and power.

If a new manufacturing plant is being erected, usually an architectural firm is engaged to make the actual drawings of the buildings. However, this does not relieve the plant engineer of the responsibility of the building.

After the parts are produced, to manufacture the product they must all be handled—conveyed or transported—as parts to the assembly. Mass-production methods require accurate detail layouts of equipment; also modern methods of handling materials must be studied and incorporated into each particular layout. The days of trucking have passed. The days of skid boxes after rough materials are received into the plant have passed. Millions of dollars are invested in machine tools to obtain precision in manufacturing, therefore parts must be processed through the manufacturing stages to preserve this precision.

In this processing many parts are first assembled into subassemblies before proceeding to final assemblies. Both the equipment to transport these parts and the equipment to produce subassemblies and assemblies are chiefly plant engineering functions.

Many other operations in the manufacturing of products are functions of the plant engineer; however, we shall only touch briefly on a few items:

1. The plant engineer is responsible for all equipment to properly heat-treat all parts according to metallurgical specifications. This is a field in which rapid progress is being made in new methods of equipment and is a very important factor in the quality of the product.
2. All equipment for plating of parts comes under plant engineering. Here many various installations have to be considered for plating copper, nickel, tin, chrome, zinc, etc.

3. The power plant, commonly known and well named the powerhouse, is the heart of any manufacturing plant. This plant is under the supervision of the plant engineer. It is here that the following utilities are produced:
   a. Steam for processing
   b. Steam for heating
   c. Electricity for power
   d. Electricity for lighting

The power plant must function so that the manufacturing plant can operate.

The installation of all machine tools and equipment is another function of the plant engineer. To accomplish this he must have sufficient working knowledge to supervise the functions of all the specialists and craftsmen of construction, such as electricians, steam fitters, machinists, welders, millwrights, sheet-metal workers, plumbers, blacksmiths, and carpenters.

The plant engineer's functions do not stop after the plant is ready for operation. All of the equipment and plant must be maintained to carry on successful operations. The following maintenance workers must be organized and directed: electricians, millwrights, steam fitters, plumbers, carpenters, sheet-metal workers, locksmiths, crane operators, elevator operators, and janitors. All are necessary and carry a great deal of responsibility in the manufacturing of the product.

All branches of engineering enter into a plant-engineering career in one way or another. No one man is ever trained as an expert or a specialist in all these branches. However, he must have a broad enough knowledge of engineering as a background so that he may cope with the vast problems that arise.

In the accompanying outline you will see the variety of general duties as well as the extent of preparation necessary to meet the requirements in plant engineering. We think that the following "word sketch," drawn up by a plant engineer with thirty years of industrial experience, is the best way to picture for you some of the ups and downs in the work.

"The proprietor of the general store in a country town is a man who takes care of everything. Aside from being general storekeeper, he is postmaster, druggist, undertaker, clerk, and preacher. He meets all comers, young and old; meets them coming into the world as well as eulogizing them on the way out. Likewise, the plant engineer takes on all kinds of jobs within the plant, from the front office to the incinerator at the back of the plant. He takes care of the flowers, the lawns, the entertainment. Any job that is a bore for other departments the plant engineer takes over. He is the anchor man on the various jobs throughout the plant that no other department wants. Like the general storekeeper, he is depended upon for everything from everybody. He is in some respects likened to the housewife whose work is never finished. There is always something coming up from one source or the other. He never has time for a dull moment. The plant engineer's function is taking care of everybody and everything. He 'covers the waterfront.' "

PLANT ENGINEER

I. Duties
  A. Analyze particular job being considered and decide necessary equipment.
  B. Secure preliminary estimates and submit them to management for approval.
  C. After approval, complete drawings and specifications. Submit to vendors for bids.
  D. Examine competitive bids and assign jobs to vendors.
  E. Coordinate work of the plant maintenance and construction departments.
  F. Follow through whole process of checking the coordi-

nation and sequence of production. Also check the installation and the equipment itself from an efficiency standpoint to see that it produces results to justify the expenditures.

G. Arrange with maintenance divisions for proper care of equipment and good housekeeping.

H. Give proper instructions to supervisors, employees, and maintenance men regarding details of the equipment to insure maximum efficiency in its use.

I. Approve vendors' invoices for payment. Close expense orders and company work orders.

II. WORKING CONDITIONS

A plant engineer works under the conditions prevailing on plant property, inside and out.

III. QUALIFICATIONS

A. Education—Essential: At least twelfth grade or equivalent. In school preparation put emphasis on English, mathematics, chemistry, manual training, and mechanical drawing.

Desirable: College degree in industrial engineering. This may be obtained through a college cooperative program (half time is spent in the technical or engineering school of a university, and half time in gaining industrial experience).

B. Training: However or wherever a man may acquire it, a good knowledge of the following subjects is prerequisite for a successful plant engineer: English, mathematics, mechanics, chemistry, strength of materials, mechanical drawing and surveying, machine design, conveyor design, furnace and oven design, heating, power, lighting, and ventilation.

C. Experience: A man with the desirable background may be considered experienced after one year of steady, intelligent application in plant engineering. Another man will generally need two years to attain the same degree of proficiency.

D. Aptitudes: Interest in industrial buildings, equipment, and machinery. Analytical ability. Ability to judge spatial relationships. Scientific or "engineering" habit of thought—being consistently logical, factual, and penetrating.

E. Personal: Ability to get on well with many types of workers—janitors, supervisors, plant managers. Ability to sell his ideas to his superiors. Resourcefulness. Inventive ingenuity. Versatility. Originality. Knowledge of the whole production process. A progressive attitude professionally which leads him to keep up to date in the constantly developing field of plant engineering.

ENGINEERING AND RESEARCH

"Engineering, the Art of Organizing and Directing Men, and Controlling the Forces and Materials of Nature for the Benefit of the Human Race."—On the Walls of the Engineering Societies' Library, New York.

PEOPLE in the professions—lawyers, doctors, teachers, churchmen, engineers—give a broad, humanitarian purpose and scope to the definitions of their work.

Manufacturers, bankers, and all men in trade who define their work in terms of economics are often too modest. Artists—poets, painters, architects—may work for the ages, doctors may save human life, and engineers may design a foolproof "sky car" to broaden the horizons of the human race. But it will often be some man who has piled up money in the competitive, dangerous game of business who endows the museums and the universities, pays for the laboratories and the hospitals, and probably finances the sky car.

We are loath to give any possible impression that it is more important or vital to mankind to work in one field than in another. If you find work where your talents lie and remember that Justice Holmes said of a man's career, "The one and only success which it is his to command is to bring to his work a mighty heart," we feel that you are bound to have the kind of working life that will in some way help others.

Hence, as we go on to extol the outstanding and unquestioned virtues of true engineers and the contributions they make to scientific progress and to the success of their own particular industries, please remember that we think all work, of any kind, is important.

WHAT IT TAKES

Anxious to point out to one of the management men in charge of production the advantages of a college education in the field of engineering, a certain professor said, "Don't you wish now, Mr. Vice-president, that you yourself had a degree in engineering?"

"Yes," came the answer like a shot, "by the good Lord Harry, I do. I wished it only yesterday, just so I could use his own lingo in telling some benighted bozo over there in engineering what a starry-eyed, up-in-the-clouds dreamer he was. Dreamer, did I say? I'm the one he's got dreaming now—had a nightmare last night and scared my wife to death. She had to wake me up, says I was pounding the bed and cussing like hell. Then I told her I'd dreamed I was trying to drive some practical, mechanical, horse sense into one of those creative artists they've got over there in engineering! Now don't get me wrong. That was really a rare case—just one of those young fellows who's still bumping up against reality. But he'll lick his problem. They always do over there, and practicality is stressed again and again in their training.

"The truth of it is, I value the engineers very highly. I appreciate their dreams and designs.

"Where do you suppose we'd be without them? Their brains and their ways are different from the brains and the ways of those of us who are production men. But it's the engineering behind a product that spells progress in the manufacturing game. No, I may rave a bit about how one of them operates—I may even rave in my sleep; but I want them to keep right on dreaming and designing and modeling and testing and drawing up the blueprints, developing and engineering the new things that we'll go to work and make.

"We need all those men in engineering, even that new chap who only plays around with smashing up molecules, or maybe it's atoms he's after now. We hire him just in case he might stumble over something, even by accident, up there in that laboratory we bought for him; and if he does, that pure-scientist brain of his will spot it if it's a genuine discovery, and then his pals in engineering will take the principles and the idea and draw it out and make up a model to show what they think they can invent from it. And finally it'll be the mechanics, like me, who'll help 'em get the kinks out, and together we'll end up with some practical, economical product that's of use to all of us."

Previously in this book we have spoken rather admiringly of the engineering personality. Under "tool engineer" we said, in listing personal traits, "A true engineer's personality—this includes, along with great self-possession and patience, the qualities of a critical, analytical perfectionist." It may well be that we are generalizing about engineers from the living specimens we have known and they may not be a fair cross section. But, taking them as examples, we "like the cut of their jib." By the way, the significance of this expression—used by Yankee sailors—may be shown by a jingle which moralizes a bit. It goes like this:

ONE SHIP SAILS WEST AND ONE SAILS EAST

Two ships set sail from the selfsame port,
And the selfsame winds do blow.
It's the set of the sail [the cut of their jib]
And not the gale
Determines whither they go.

Like the ways of the winds are the ways of the fates
As we chart our course through life.
It's the set of the soul
Determines the goal
And not the calm or the strife.

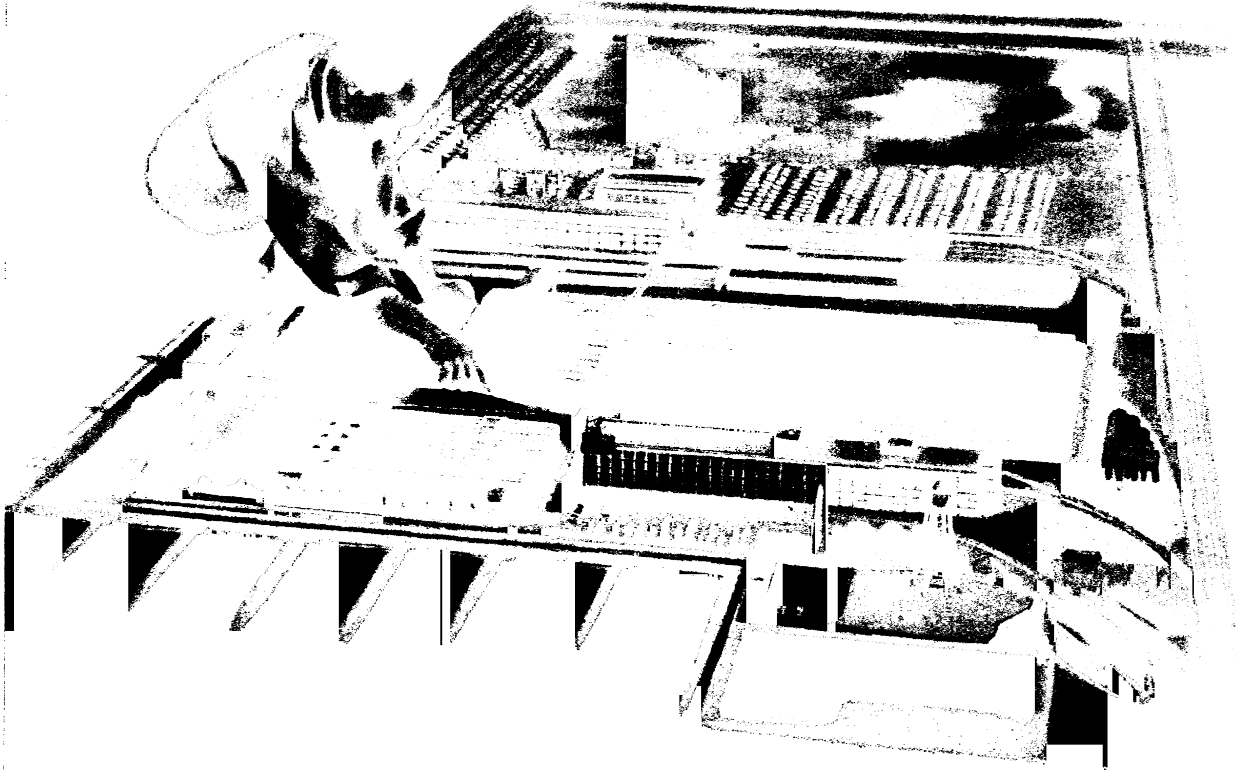
Some salesmen will tell you that engineers can't talk well; they can't persuade people forcefully and perhaps dramatically; they can't put themselves over, they'll say. Some executives will say they're too slow to decide; they aren't ready to gamble; they have to be sure before they take action; they're not decisive enough, or not dynamic enough, to ride roughshod over anything that stands in the way of a desired end.

On the one hand some people think that engineers are rather too sure and dogmatic in hanging to the traditional fundamentals, the established principles, the unwritten as well as the written laws of their profession. But on the other hand those same people may complain that engineers are a temperamental, creative crew, always thinking in the abstract, even indulging in flights of fancy.

In spite of the foregoing possible weaknesses—which we think it salutary for young people aspiring to be engineers to evaluate and consider in planning their own course of personal development—we all of us recognize that it requires a definitely high-caliber individual to be a real engineer.

The dictionary definition of engineering is, "The art and science by which the properties of matter and the sources of power in nature are made useful to man in structures, machines, and manufactured products."

So the great engineer, the top-flight man, may be that almost superhuman combination—an artist and a scientist. This definition explains too, if you'll notice it, some of the contradictions in the supposed weaknesses that non-engineers



pick out—dogmatic and temperamental, or should we say law-abiding and creative?

It is well to remember that we are generalizing about this engineering personality. Within such a big field you will find all kinds of individuals with quite different traits. The extroverted, gregarious, aggressive leader usually develops into an executive engineer. The chairman of the board and the president of General Motors are typical of such men.

The extremely creative, idealistic, meditative, intensive analyst becomes a research engineer. The pure scientist research man is exemplified by Steinmetz of General Electric, the pioneer in such work for industry.

An engineer with a decided interest in and flair for human relations and the ability to develop others becomes the teacher-personnel type of engineer, found so often in the schools of engineering of the universities and in some personnel divisions of industry.

The man who likes to deal with people, who is articulate, likes to explain the engineering and technical virtues of a product, and is persuasive and adaptable, may become a sales engineer.

The man who wants action and likes to be connected with the building of things becomes a production engineer—or a liaison engineer between the engineering and production divisions.

The imaginative, ingenious man who likes to diagnose, ferret out, and design better methods may be called a product and project research engineer, in contrast to pure or fundamental research. "Trouble shooting" in engineering will often interest this type of man, as it always does the production engineer.

The one who enjoys testing—a continual analysis and tryout of a product and the testing of all materials used to see if they meet quality specifications—the persistent, thorough, intent man who likes technical work in the physics, chemistry, spectograph, electronics, and such-type laboratories will become a test engineer.

And then there's that gifted, creative, so-called up-in-the-clouds inventor-type of man who can dream up a brand-new product and also has the talent to design it—the developmental engineer.

And there's the man talented in drawing who can take his own and sometimes another engineer's ideas and draw up blueprints—a design engineer.

In different companies these engineers bear somewhat different titles but all of the types are to be found.

Before we write anything more in this high-light sketch of what it takes to be an engineer in industry we want to refer you to the best source for going into the subject thoroughly. A pamphlet entitled, "Engineering as a Career,"[1] will give you an excellent digest and also a partial list of twenty-five publications on this subject. If you do not find this pamphlet in your library you should mail ten cents when sending for it.

Engineering as a profession probably offers wider variety of opportunity than does any other profession—at least, so the engineers tell us. You may divide the field into five broad classifications: civil, mining and metallurgical, mechanical, electrical, and chemical.

The manufacturing industry in a big corporation will employ men from all those fields except mining; and in the few cases where a corporation owns its own mines, it will employ men from that field also.

In considering whether or not you have what it takes to become an engineer, we are going to list at the end of this write-up certain points that a number of successful engineers have agreed you should think about. They are guideposts the old-timers have set up for the young men, or in very exceptional cases the young women, who are thinking of taking the first steps along the rather rough and rocky road which leads first to an engineering degree and then to the experience and self-development which produces a real engineer.

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[1] Published by the Engineers' Council for Professional Development, Engineering Societies Building, 29 W. 39th St., New York.

However, we will tell you now that a high-school student should stand in the top third of his class and have won consistently high marks in mathematics and science.

We also are quoting for you now from a section marked "Warning" in the pamphlet to which we referred: "High-school students and others all too frequently make the serious mistake of regarding manual dexterity and ingenuity—the ability to make things with the hands—or an interest in mechanical things, as indicating engineering ability. The failure to make a proper distinction between manual dexterity and engineering ability has resulted in many a man's becoming at best a mediocre engineer who otherwise might well have had a more profitable and satisfactory career as an artisan or skilled craftsman." As we interpret this statement after conferring with many engineers, it does not mean that mechanical aptitude is not highly desirable in many phases of a mechanical engineer's work. It means that craftsmanship alone and of itself will not point to real engineering ability.

Big corporations secure engineers in various ways. One of the automotive group selects promising high-school students and trains them in their own engineering institute, alternating work experience in the plants and classes in theory; at the end of four years a bachelor's degree is awarded from the institute. This same company hires graduates of the schools of engineering for certain work, and also conducts a college cooperative program, a five-year course, leading to a bachelor's degree from the university (Northwestern, Cincinnati, and various others). This combined work-study program, when well coordinated between universities and industry, seems especially well suited to production engineers, to the very necessary liaison engineers who function between engineering and production divisions, and to the development of management or executive engineers.

However, in the last analysis, the kind of engineer you become—the type of work you do as well as its quality, mediocre or outstanding—apparently depends upon you as a person.

Another automotive company with very high standards selects graduates of universities and offers them a two-year training program leading to a master's degree in engineering. This same company is affiliated with twelve universities in a college-cooperative engineering program of five years, leading to a bachelor's degree.

The ultra-modern laboratories, the excellent training facilities—considering both equipment and teachers—to be found with big industry, reflect the expenditure of money, zeal, and eternal diligence which keeps them continually in the foreground of progress in engineering.

We haven't told you in any detail or at any length what you will do in industry as an engineer. However, we will wager that the young person sufficiently imaginative and penetrating in his thinking—without which faculties he'd better not even flirt with the notion of being an engineer—has absorbed from this write-up the general atmosphere of the kind of career that engineering offers, as well as its place and standing with industry.

It is obvious that you must have creative and inventive imagination as well as technical knowledge and skill in your specialized branch of engineering. A broad grasp of fundamentals should always precede specialization. But even if a man is going into the teaching of engineering it is inevitable that he should become specialized. As he grows and develops through experience he will become more and more of an authority in some particular section of his chosen field.

Nevertheless, like a good doctor, he will try always to retain, however finely delineated his special skill has become, an over-all, practical, horse-sense view of his professional work. It is this perspective which makes an eye specialist see not two isolated organs of vision but a human being with all the complex mental, emotional, and physiological states which affect his two eyes.

And it is this horse-sense view which makes a test engineer in the electronics laboratory see more than an isolation of the elements of matter, as he records his data from the dancing electric waves which tell him all about the breakdown of a microscopic piece of metal. It makes him see and interpret the essentials of his breakdown in terms of what is needed in the way of practical durability for the material before him, depending on the structure of a final product and how it is to be used by man.

Whether you become almost an artist, working in a quiet, cloistered room on a plaster model of a part of an aeroplane; or a liaison production engineer hustling after facts out in the shop to rush through the specification changes on a new-model automobile; or a designer bent over a drawing board almost anywhere (he will be too absorbed in his work to care where he is) who is striving like mad to catch on paper that dreamed-up design which he sees so well in his mind's eye—if you have found the kind of work with which you feel completely at home and which for you often obliterates time, you may count yourself lucky, for you have what it takes to be a real engineer.

HOW IT OPERATES

To describe the manifold duties of all the engineers working in big or little industry is quite obviously far beyond the intention of this writing. Many volumes have been compiled about the work of each specialist in the field of engineering. The libraries are full of books and of information on the subject, both in scientific treatises and in popular magazines.

The public at large is also becoming better and better informed in a general way about the work of professional engineers through the medium of moving pictures and the radio, and television will do still more to keep us up to date about the scientific research and the engineering marvels of a new world.

The challenge to applied scientists and research engineers to see to it that the released and controlled power of the atom —its staggering potential energy—should make us and not break us on this planet is a challenge which has arisen in our time. And the public as well as the oncoming generation of engineers becomes increasingly aware not only of the enormity of the challenge but also of its significance as we plan our way of life.

How the engineering division operates in a big industrial corporation is more than we can adequately describe for you, because they do so much.

As you have seen previously in this book, most of the workers we have written about began their work by interpreting blueprints and specifications from engineering. Any changes to be made in a design of even a small part of any product, or any slight change in the specifications, had to be initiated or approved by engineering.

All material either bought or fabricated in the company's plant had to be analyzed and tested and approved in the laboratories of engineering. And whenever the company gave birth to any new product it came from engineering—the design for every part, small clay and wooden models, a life-size, complete model or facsimile of the finished product itself, and finally the blueprints.

In fact, it seems as though the industrial engineer, like a very different type of man, the locomotive engineer, is the man with his hand on the throttle. However, when it comes to ultimate control in industry there is always some person or some group somewhere above you, with a greater authority than yours, who must be served and deferred to.

"Why, what's this?" you say. "There must be one ultimate authority in a corporation; if it's not the president himself, how about the board of directors and its chairman?" But the board of directors must satisfy the stockholders. And what if there's one man who controls the stock—doesn't he rule things? But he, powerful as he is, must serve the public. His industrial products must be approved and bought by the public to keep his business going—and he must meet competition; prices must be right. Then perhaps it's the financiers, the budget men, who control the throttle, for, as they say, "money makes the mare go." But a company needs human beings—workers, both leaders and followers.

You can't forget the human element. People must work and produce or the best budget ever planned won't supply the customers. In the last analysis the only ones in control are the customers of engineering—the customers of industry.

The brains, the creative art that dreams up and designs a new product, the scientific knowledge and skill that develops and strives to constantly perfect that product, are an all-essential part of industry. But—and mark this well—no one group can be really said to have its hand on the throttle. Industry is built on and survives by means of service and teamwork. And even such independent Yankees as we individualistic Americans believe in working *together* to make things —in working *together* to keep effective the free enterprise of big industry.

You're going to be a person who is mighty important to a company if you become a member of its professional staff of engineers. But, by virtue of the fact that you have grown to be a real engineer, your ability to analyze and evaluate yourself objectively in proportion to the whole scheme of things will keep you sane, humble, well balanced, and hence well thought of by your fellow men. So expect on the whole a happy life; for you may, as one of the clan of engineers in industry, go a bit high-brow but you'll never go high-hat!

GUIDEPOSTS

In deciding for or against engineering as a lifework, the following guideposts, set up by experienced engineers, may help you:

1. An engineer must have initiative. He must have the gumption to take responsibility and follow the course of action which his judgment indicates, yet he must know when to abide by the judgment of others.
2. A good engineer must know how to keep after a project until it is completed. Lack of this ability to follow up probably retards the progress of more engineers than does any other single failing.
3. Absolute honesty is even more important in engineering than in other fields. The physical universe with which the engineer must deal operates according to law and will expose dishonest interpretation of data without mercy.
4. A successful engineer must be able and willing to work under pressure; that is, in the interests of both his health and his efficiency he must not allow himself to become tense under the strain of making responsible decisions and meeting deadlines.

5. The ability to analyze a problem and identify its important elements is essential for the engineer who wants to be better than mediocre. He should have an inborn curiosity about how things operate and are put together.
6. Although men with exceptional personal qualifications have risen to success in engineering in the past without formal training in an engineering school, the lack of such training in the future will be a handicap too great to be tolerated even by the exceptional men A formal engineering training will therefore have to be completed.
7. The completion of such training requires a thorough knowledge of mathematics at least through the calculus. Hence an engineer who does not like mathematics will probably not be happy in the profession. A man weak in mathematics will be at a major disadvantage in the technical engineering field and will eventually find his weakness a limitation to his progress.
8 Success in engineering, like success in most other fields, depends on being able to deal with people. This means being able to get them to do what you want done without closing the door to further contacts with them.
9. The ability to express his thoughts in simple, direct, and correct English is of great value to the engineer. A fact established must be passed on to others before full benefit can be realized from it.
10. Manual dexterity in handling tools is not essential to engineering success but is helpful to the engineer, not so much in enabling him to show others what he wants done as in winning the respect of the mechanical-minded men who work under him

And finally, even though proceeding from a broad educational foundation in engineering to a highly specialized field, a man should be anxious to develop qualities of mind and personality that will help him evaluate his own work in the light of its contribution to industry and to society.

SPECIALISTS

FOUR men are eating lunch in the executive dining room of an industrial plant. The long, lean, lanky one, with nervous gestures, is a lawyer, a patent attorney; the big, florid, two-hundred-pound football-center type who sits so stolidly—but he can use jujitsu—is the head of plant protection; the very blond man, dressed in a white coat and trousers and with the surgically scrubbed look, is a doctor; and the fourth, fairly tall and fairly heavy —nothing extreme about him—looks like a conservative banker type; there's no professional Van Dyke beard, although there is a high forehead; however, whatever he may look like, he is a teacher, the head of industrial education.

(People, their faces, their hands, their ways of handling themselves, are always interesting to watch. The reflections of their careers may not be seen, but the reflections of the kinds of men they've become is often there. It seems to us that it bears out the one bit of direct advice you will find in this book: "Expect and be geared for change, but hang on to your own ideal aims, whatever they are." And both the nature of those aims, and the character you've shown by how well you've hung on, will be written somewhere about you for someone to read.)

All of the four men sitting there together in the factory dining room are specially trained for certain work—for the professions of law, medicine, and industrial education, and if you speak of it academically, the man in the business of protecting people's lives and property was highly trained for the profession of sociology.

Industry is full of specially trained men, not only designing and manufacturing specialists, engineers, technicians, and skilled tradesmen, but also many and diverse experts who are needed for the successful operation of a big enterprise. Some of these special workers are concerned about the property of a big corporation; some are concerned primarily about people; some, like the police or the firemen, look out for both property and people.

Heretofore in this book we have quoted actual individuals, or else we have said a dieman or a master mechanic "might say," and whatever words we put in his mouth were a composite of the actual words of several people. In this section—to give you the picture of specialists—we are going to imagine an old-timer and imagine his words. As they say on the radio, "The next voice you hear will be that of an old-timer in industry."

"If you've got a job to do, get going and keep plugging. We can't wait for a print from engineering, a schedule from planning, and an operation sheet from master mechanics to tell us just how to go about it to give a man interested in careers a general view 'bird's-eye view,'—you said—of specialists. So we'll start from that executive dining room you were poking your nose into. (Snoopy business, this journalism job—surprising the way you take to it!) Well, the first special jobs are those of dietitian, chef, and baker. In the cafeteria and the dining room we pay a lot of attention to the breakfast and lunch that it is possible for people to buy; well-trained people plan the variety of foods and skilled people prepare it. Both men and women can qualify for these jobs.

"Now let's move out of the dining room, and let's say, for the time being, that you're a visiting celebrity of sorts. The arrangements to be made for your visit to this plant will have been settled by the director of public relations. It is very important to keep feeling the pulse of the public and to interpret their feelings to industrial leaders, as well as to help less articulate phases of industry explain themselves to a public which is growing increasingly interested in their achievements. That's a pretty formal way of saying we like the public and want them to know and like us. Of course they know us by our products; but these public-relations people, they do like the fellow said good manners do—they keep oil in the machinery so that things run smooth and easy.

"Supposing we imagine now that you're staying down at the Statler. There'll be what we call a courtesy car that picks you up and delivers you to the main lobby. You'll be greeted by an expert in good will, a receptionist. He's the man who arranges for the courtesy cars and drivers and who checks credentials of visitors. Pretty important that was in wartime. This specialist, who's the kind of fellow who lets you see from the word go that we're inclined to be hospitable around here, will give you a pass and a badge. Then he'll send a messenger with you to the one responsible for you in the plant. However, you won't step outside the lobby into the first corridor without getting O.K.'d by the plant police. The officer on duty gets a copy of your pass and he checks your copy; then, before you can get out of the plant, you'll have to hand back both your pass and your badge. It seems too bad not to tell you all the duties of the plant police and the plant firemen too. I'll tell you this—not only do their jobs require shrewdness, ability to get on with and to handle people, courage, and poise, but those fellows put up a bond; and do they put them through a course of sprouts when they investigate their past record and their character references! They're tops, those men, in their special line of work.

"Now where were we? We said you were quite a celebrity, as I remember. So perhaps we'll have on hand another specialist for the company—a photographer—and take your picture. Not to boast, you understand, but we're noted for our photographic department; they know their stuff.

"Before we start calling on some of the specialists you want to find out about, I'm going to suggest that you're a kind of absent-minded individual who forgot to send an important wire before you left the hotel and you want to use a telephone and send it collect. Of course there's a switchboard, with a regular staff of trained telephone operators who work for a large company, but we also have a telegraph station, cooperating with Western Union. You can write out the wire and we'll send it immediately. And if you had to get off an air-mail letter, our special-mailing division would speed that along. If it so happened that you'd had trouble about a reservation for your return trip to Washington, we might put our railroad representative on that. He works under the traffic control where several traffic specialists, including a man called a yardmaster, are dealing day after day with transportation problems, both passenger and freight, on the land, on the sea, and in the air, as they say nowadays.

"Well, let's get on with this job. We'll have a little session first with the lawyers—patent attorney is one kind; there's also quite a group hired especially to study and interpret all the laws that relate to industry; some of them get to be regular specialists on labor laws. If you can 'take it' to be reminded of your own struggles with the income tax, you can talk to a tax expert at this same time. Now before you come down from the so-called higher levels of learning after visiting with these legal lights, you'd better stop and visit three more specialists. These three have quite lately found new fields to conquer right inside industry. Perhaps I'd better say they, like the lawyers, are bringing their knowledge to be sifted together with the know-how of industrialists in the hope that better living for all of us will come out as a new product. These gentlemen (though the Lord knows they could, in this day and age, be all women!) are a psychiatrist, a psychologist, and an economist.

"It occurs to me right here that you might like to see the place where we can treat a headache. Let's go on to the medical division. Of course a lot of doctors, a few of them women doctors, are working around here and they've made a pretty thorough study of the medical and physical examination you get before you're hired. Then they and their nurses and also a physiotherapist do all they can to help you keep well after you've been hired. If you have a headache or pain or a cold, they'll advise you as to whether you should go home and see your own doctor or perhaps just rest awhile. They give first aid in case of an accident. Important, you know; the tiniest scratch has got to be looked after. The physiotherapist gives treatment, under the orders of a person's own orthopedic specialist, to an employee injured in the plant.

"There's a lot of attention, these days, to preventive health measures. A career in these expanding medical divisions of industry to those young folks who will earn their degrees in medicine and in nursing is a mighty satisfying kind of career. An awful lot's been done around here in this line of work since I was a young apprentice, but, by George, I can see there's a lot still to come—a lot still to come in all kinds of work all around the world, if you ask me.

"Now we've got another specialist, a public-health doctor, who's watching out for people's health in a plant. They call him an industrial hygienist. Anyone who wants to do research in medicine in the most practical setting ought to see how these fellows operate. They analyze plant conditions and tell us how to keep the place hygienic, just as free from germs as we can. It's a big subject; you've read about it—lead poisoning, silicosis, dermatitis. Industrial hygienists are conquering these and many other diseases by showing us certain preventive measures—telling us we must remove the dust from the air in the foundry, or what kind of coolants to use (coolants are oils or chemicals that run over the tools that are cutting metal to keep them from burning up). Can't go into it all now, but industry presents a great field for public-health people.

"Right over there is the engineering library, so librarians have to be hired; women are good at that. There's a group of what you might call banking specialists in the credit division; there's a customs clerk we need to hire in our business and then there are linguists. You'll read about interpreters and men who speak foreign languages under 'Export.'

"There are many trained statisticians needed in industry. Statistics, one of my mathematician friends once told me, is a science. I have a queer kind of memory—never know what'll stick—but I remember the way he put it, perhaps because we argued over it. He said, 'Statistics is the science that deals with the collection, tabulation, analysis, and presentation of numerical data or massed facts'. All I know about it is that ordinary folks like me can get the gist of a situation which at first looks to us like a lot of complicated figures, as soon as one of these statistical experts has boiled it down and pictured it out on a big chart.

"And that carries us to the other specialists who have trained in all kinds and varieties of business administration. As you can well see, these 'office people' are all over the place and we couldn't get along in industry without them. Some need college; some need much less training. Auditors and certified public accountants hold responsible jobs. So do private secretaries. It would be quite a story if I could tell you the amount of reliance that one of the higher-ups—especially, perhaps, the men in top management—must place on their secretaries. Some of these secretaries are themselves higher-ups, I guess, for they call them executive secretaries. The women in these jobs, as well as the men, have an opportunity to study big men in action at a close range. I've been around here a long while, you know, nearly thirty years; but I'll bet one of those girls who's been here ten or fifteen years, right with the same boss, might know more than I do about how this whole business runs, and she keeps it right under her pretty hair-do! I swear they get to be good. Trouble shooters, keepers of secrets, ego boosters, and all under this self-effacing, poker-faced, withal super-efficient look—at least, that's the way they look in their more formal moments. I don't know how they feel about it themselves, but the way I see it, the top ones have a mighty interesting kind of job; and I know that to be a real secretary functioning under a real leader in industry, a man or woman needs brains, character, and diplomacy plus.

"You can easily see that scores of competent, business-trained bookkeepers, cashiers, typists, comptometer operators, dictaphone operators, and skilled key-punch operators are needed. Some of these are men, many of them are women. The woman who not only becomes expert in her particular job but who develops finally into the head of the division —the supervisor of a large group of dictaphone or comptometer operators—must be unusually efficient in human relations as well as in business knowledge and skill. She's another woman specialist of whom industry can be proud.

"I seem to be all out for the ladies at the moment, so I'm going to not only take off my hat but make an extra bow to still another kind of woman specialist, the matron. Often, in contrast to the others, her training has not been in school. She has generally become expert through long service on the job. She is not responsible for doing janitorial work. She works under the direction of a supervisor, usually well qualified and trained in personnel work, and she takes care of

women employees in their rest rooms. As an old-timer I've seen what a swell job she does in making women more comfortable, more content, and better workers for the company. She's an asset. And although it's not a specialist career for young people, I had to tell you about the matron. Maybe some of the younger ones who read this have mothers who qualify —it's a kind of mother's job.

"If, as a visiting celebrity, you have looked in on and chatted a bit with all these specialists, you'll be about ready to get back to the Statler Hotel and lie down for a good nap, won't you? Well, you'll have to come another day, then, for there are still more specialists. Metallurgists and gear specialists, to name only a couple, are typical of these men. The engineering and technical divisions of industry must hire many men who have specialized along one line of work. However, I think you can get that nap, for we set out to do a job of naming the specialists *apart* from engineers, technicians and artisans, remember? Not having had a blueprint, we've missed some, I'm sure. But you said a bird's-eye view, and no one bird sees everything, even the wise old owl. It's maybe taken me thirty very full years to learn that no one bird sees or knows everything. But I spent those years in industry, so I learned it."

SALES

PERSONALITY is something more than suavity of manner. It comes from being ourselves—not from aping someone else. A reticent man can't be a hail fellow well met. He would be a contortionist twisting himself out of all semblance to his self. Successful men are *themselves heartily*, some of them quietly, but all of them heartily. Personality is a radiation all one's own.

"When a man has a job suited to his talents, he becomes dynamic and people say he has personality. The same man on a job for which he has no talents could not be dynamic and people would say he lacked personality. Personality could be defined as a combination of strong talents and the appropriate job."

We quote the above two paragraphs from Dean Schneider's book, "The Problem of Vocational Guidance," because many people say salesmen are people who have "personality plus." They are thinking of Bill Brown or Harry Moore—some supersalesmen they recall. But as a statistician, the same Bill Brown might be thought of as a poor downcast dub with no personality at all.

It seems to us a happy thought that "what most endures is changeless change," for there are many men beyond the years of youth whose talents have not yet unfolded under the right stimulus of the right setting.

And if the hand of fate or chance doesn't pluck such a man from a job that is killing his spirit, he must have the courage to get out and find the work he has a genius for.

When his talents fit his job he will approach his work with a sense of adventure and zest. And each man has a genius for some work. Some men, of course, with broad and varied talents, have a genius for many things.

If Steinmetz or Edison could have been made to "ape another," which seems impossible, they might well have pushed themselves into doing the job of P. T. Barnum; but they would very likely have died unknown, drudging around with a one-ring outfit and maybe trying to nurse along a couple of sick elephants while dodging the sheriff.

If you like to persuade and influence people to buy things; if you like the challenge and excitement of business competition; if you like to approach strangers; if you like to adapt yourself to different people and to their different moods and local customs; if you like to intrigue new customers; if you know how to use showmanship at the right time in the right amount; if you like to satisfy and hold all your customers; if you like to "open the door" and to "close a sale"; if you can put yourself in the shoes of the other fellow, whether he's a butcher or a banker, see things from his point of view and then tell him clearly and concisely the story of your product's usefulness to him; if you can count a rich man or a poor man, whenever and wherever you meet him, as a friend, for whom you really like to do a service—then you probably have talents that will help you to succeed as a salesman.

There are many men who have so well developed their ability to do direct selling to the public that they have built up careers in personal retail selling. Whether they sold drugs, insurance, automobiles, real estate, bonds, or any of a thousand industrial products, their talents lay in their ability to make sales. And that was the work they wanted to do.

Promoters of ideas are also men who practice the art of selling. We speak of a politician who is interested in "putting himself over" in order to get votes as having the ability to "sell" himself. And we all know the type of smooth actor and smart aleck who goes in for the ballyhoo at a carnival, the "con" game, the cure-all medicine, the disappearing-pea game. But we also recognize that Abraham Lincoln "sold" the high ideal of unity and the preservation of the principles of democracy; and we speak of a statesman like Winston Churchill as being a real salesman even though all he was offering his people was "blood, sweat and tears."

The art of persuasion and the practice of negotiation go far beyond convincing a man that what he really wants is to hand over some money in order to buy a bicycle. We have not yet found a way to measure on a scale the intangibles or varied talents which enter into the practice of salesmanship. Nor have we found a way to prescribe an academic course of training, a definite type of school preparation, which is certain to help in developing sales ability.

We can see the good sense behind this combined opinion of leading psychologists, "Salesmanship does not exist as an isolatable and independent personality phenomenon."

We have not yet found the answers as to how to plan a preparatory background that will develop successful personnel or human-relations experts. And we can't give you a system to produce successful salesmen or sales executives in industry. However, some very effective training courses in the techniques of selling are available and have proven useful to many business organizations.

We go into this question of what it takes to be a salesman because retail selling very often proves to be a sound foundation, an excellent training, for the building of a career in the sales division of industry. But it does not tell the tale of all that it takes to be a sales engineer, a business manager, a service manager, a field representative, an advertising executive, a sales executive, with a big corporation. Factory representatives and sales managers may well profit from the course of sprouts or the building up of skill in human relations that successful retail selling will mean; but they must have other talents and gain other experiences than those which go into the art of salesmanship.

For example, a man who is to work in sales for DuPont might well be a chemical engineer; for Lockheed an aeronautical engineer; for General Electric an electrical engineer, and so on.

This does not mean that all three of those companies hire for their sales divisions only men in the field specified. This sketch about sales will give you some generalized, spotlight information, not a complete and particularized picture; such a picture you must obtain directly from each type of industry. For the setup of a sales division in industry differs according to the nature of a product and its market.

To sell tires for the Goodyear Tire and Rubber Company you can start as a branch representative, or in the shop in production; after this experience you can become a salesman, selling to local gasoline and tire stations, and later a field representative, still later a field manager. However, you can also start with the automotive sales division of Goodyear as a sales engineer, if you have a degree from a school of engineering, and you can work up to sales manager of that division, which is responsible for selling the original tires on an automobile to the manufacturer. This, as you can see, requires engineering knowledge—knowing the right tires to be planned for different types of automobiles and trucks.

If you're interested in the automotive industry you will be welcomed as a prospective sales executive in the truck end of the sales division when you have engineering background. However, to be an automotive sales executive in control of appointing automotive distributorships and dealerships all over the country—as well as responsible for selecting, developing, and supervising the factory field representatives in various territories who give help to these private dealers or distributors—you will need not only sales but also accounting, organizing, management, and even coaching or training ability.

One out of the many kinds of school backgrounds or life backgrounds that have produced successful sales executives (some of whom later became top-management men in industry) consisted of an extroverted four years at college—leadership on the campus and in sports—plus the getting of a master's degree in business administration. But remember that this is one man's experience and you, as he did, must work out your own salvation. Johnson, the man we have in mind with such a background, stuck at it until he found the work where his genius, his talents, would evolve and unfold. And as a consequence his career is still for him a life of challenge and of high adventure.

Johnson says that when he arrived at college the dean took a look at his high-school record and said, "Excellent work in mathematics. Well, my boy, you'd better be an engineer." The first year's work went well—he liked the math courses—but Johnson was keen enough to see that he'd better have a closer look at his future working life; so he got a summer job at Brown and Sharpe's in close contact with the engineers in industry.

The next fall Johnson said to the dean, "I'm sorry, sir; I don't like engineering." And he told him why. The dean leaned back and thought about it awhile and then said, "Well, there's still the mathematics; your grades are tops. The certified public accountants are coming into their own these days. You take that up."

After another year's work, Johnson again took a summer job, this time in the accounting division. He watched closely what the man above him, who was an auditor, had to do. And he worked all summer entirely with figures.

But before fall Johnson had to kick himself to work every day.

At the opening of college he was again in the dean's office. "Sorry, sir," he said again, "here is your problem child. I can't stand the monotony of that tied-to-a-desk-with-only-figures-in-front-of-me job. I don't want accounting for a career."

This time the dean grinned and didn't hesitate. "Johnnie," he said, "I know you better now and we've both got more to go on. You're into everything on the campus and you're a leader. You'll find a place in business where you're dealing with people. Just take liberal arts until you're through here and then go up to Harvard and take business administration. But, Johnnie, consider your talent in human relations as well as in math when you pick out your next job or you'll keep on making a liar out of me!"

In talking with Mr. Johnson, who is now the president of a sales-and-service corporation which acts as the factory distributor for a big industry, we decided that the college-cooperative course in business administration[1] was like a streamlined edition of his own experience and might prove a wise school background for a man who thought he would like to build his career in sales in industry. However, there's no royal road to success anywhere in industry. It takes in sales, as in production, common sense and hard work.

Engineering, production, sales, form a triple alliance to get the ball rolling, keep it rolling fast, and finally shoot—or maneuver—it through the goal. They play on a still bigger team where management directs, coaches, and plans the strategy, while finance buys the equipment, watches the returns at the gate, pays for the stadium, and holds the purse strings. And thousands of human beings either buy a ticket and root for the team or stay at home and say to themselves and to all their neighbors, "That team's lousy this year; something must be wrong; they've lost their punch—there's no 'oomph' to them any more; they don't belong in the big league."

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[1] See chapter on "The Schools and Industry," pp. 204-213.

The selling of a product is a vital factor in the continued employment of the workers in a particular industry. In the write-up of engineering we said, "Industry is built on and survives by means of service and teamwork." And we also said, "In the last analysis the only ones in control are the customers of engineering—the customers of industry."

It is the sales division which satisfies the customers; the more customers the more employment, and the more employment the more potential customers for the sales division to sell to. This beneficent cycle is the thing we all hope for when freedom of competitive private enterprise may again give encouragement and opportunity to men of initiative and industriousness, and postwar industrial opportunity to produce and expand is again part of the American scene.

Sales in industry must meet competition. The executives in sales must predict what the unpredictable public will buy, and how much of it. They must so advertise, distribute, and service a product that good will, popular esteem, and a high reputation are built up and held.

The man in charge of advertising depends on copywriters, commercial artists, and advertising-agency people to submit good campaign material; but it is he who must know his own industry and get from the agency the kind of copy that he can stand behind as the right and reliable information for the public.

The business manager in sales must keep the balance. His market analysis as well as his budget must prove in cold-cash figures that he has both vision and judgment.

The field representative must be more than a dealer in platitudinous patter picked up at the factory and relayed to a

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dealer in the field, along with a certain good-fellow backslapping and gossip about hunting and golf. He must be a keen, analytical, forward-thinking "builder-upper" who gives concrete suggestions to help a dealer improve his business. He must inspire confidence, shoot trouble, and become a sought-after business consultant. All this takes a growing mind, kept tuned to changing industrial community and world conditions.

A factory service manager, with certain products, such as automobiles, plays a major part in holding customers. He should have the ability of a skilled repairman and diagnostic mechanic plus the ability to engender good will and serve the public.

And now what about a sales manager in, for example, the automotive industry? He must be of the caliber to become a leader in management. In discussing master mechanics and planning we spoke of the characteristics of such men. You'll *earn* your way to the responsibility of an executive, and you'll find that your past record in industry will be your main credential. Character, a sound reputation, personal and financial, and proven ability are what you as a sales executive will insist upon from the distributors and dealers to whom you will sell your products for resale to the public. And the top management of industry will ask no less from you.

"By their deeds ye shall know them." Through your art of presentation goes the story of the good deeds of industry. Through your skill in service goes the distribution of useful products. And useful products, made available to more people, are the material answer to a better life for most of us.

Part III - - - - - - - - Chapter 20

EXPORT

With the world-spreading factories
He interlinks all geography, all lands.
Are all nations communing?
Is there going to be but one heart to the globe?

WALT WHITMAN saw far beyond his time. It may be that some of you who dream today of work in foreign lands, of making or selling industrial products all over the neighborhood of the world, seen from the sky and reached through the air, are a little ahead of your time. And then maybe some of your elders—and supposedly betters—who scoff at such dreamers are a little behind the times.

We don't know, in this day of European and Asiatic upheaval—in many places desolation—just what the future holds in the way of opportunity in the export division of American industry. We can guess that there will be expansion. The facts about how expansion will come about are not settled at this time.

We do know that some young men who are studying foreign languages—perhaps one year of Spanish in high school—who expect to be hired by any of the big industries immediately upon graduation for a glamorous, romantic life in South America or perhaps in Spain, becoming almost overnight full-fledged industrial pioneers, are due for a jolt.

No one will hire them with any such idea in mind. And the story is just the same for college graduates who have majored in foreign languages or modern history. We are considering, just as we did with the other divisions of industry, what it takes to work in, and in time to build a career in, the division of export.

We recognize that the picture may well change, but right now the opportunity for immediate work outside the country for American students who know one or more foreign languages is likely to be found with government service, or, in the case of qualified pilots, with commercial aviation companies, for graduate engineers and accountants, with the oil industry.

Certain big manufacturing industries here in the United States will train students from China, South America, and other foreign fields to go back to work under export in their own particular countries. In the main, big industry will continue to employ "natives" who thoroughly know their own countries—the customs, the traditions, the business methods, and the peculiar needs—to work in the foreign field, in the factories, the assembly plants, the service and distributor companies which they either own or do business with. This also applies to the foreign branches of finance or insurance operated by an American industry.

Especially during the postwar reconstruction period will the big industries *lend* for a period of a few years some of the experienced industrial engineers and technical experts as consultants in the export field. And they may also recruit well-qualified and experienced mechanics to go to a foreign country to help get the ball rolling in new factories or service divisions which are being developed.

Then, too, as in the past, certain key people from industry will be appointed as foreign representatives, regional managers. The man selected for such a job has often lived for a long period in one or more of the cities or small countries where he is sent. Although he is a citizen of the United

States and has grown up in a particular industry long enough to acquire the broad knowledge of perhaps a plant manager or a comptroller, top management also wants him to know very well the particular foreign field where he will be responsible as their export representative.

All of this, you may well feel, doesn't encourage the youth of our own country to aim at export for a career. However, there are some industries—electrical, aviation, automotive and others—which will employ college graduates in liberal arts as well as in engineering and commerce whom they will eventually head toward export, after they have proven themselves qualified in the engineering, sales, finance, or production divisions of the corporation.

You may be asked by a company, after you have made good here in the United States, either to learn or to brush up on a particular foreign language if you are interested in export. So it might prove useful to you if you study in college the history and language of the country where you feel you would like to live and do business. Of course the young man who is thinking of export as a means for wide and delightful travel, a chance to see the world, is just a wishful thinker. It doesn't happen that way.

With some corporations it is true that there are *limited* chances to start with the export division and learn the business of export from the ground up. If you are a college graduate in liberal arts and are hired by export to be thoroughly groomed, you will probably start as the chauffeur of one of the courtesy cars of the division. In this way you will meet at airports, railroad stations, or hotels the incoming executives, the distributors and service managers, from far-off parts of the world. After this job you'll very likely be put at a desk in the central office of export to learn the paperwork. You'll copy orders from distributors all over the globe. If you're with an automotive corporation you'll soon learn that England must have a car with a right-hand drive and that no cars painted red are ever sold in Japan; you'll know that the truck specifications for the mountains of Switzerland differ from the specifications for the Sahara Desert.

As time goes on and you grow up you'll move to the export customs department. This involves detail work and accuracy, and if you should prove a natural on the involved customs regulations and taxes, you might move up into supervision and stay on in that kind of work.

However, if you have potential sales ability, you might move into the parts supply or merchandising, and then on into business management, involving parts service and sales in the export field. And finally, after several years of this steady grooming, if you were qualified you might be sent out to the foreign field as an assistant to a foreign regional representative, or as a worker in some foreign branch of export to learn about the people and the country at first hand.

Naturally this picture of how you might grow up in export is dependent on the varying policies of separate industries. One big automotive company owns and completely controls all the foreign factories, assembly plants, and sales and service centers for distributing its products. Another big automotive corporation does not believe in owning any property in a foreign country but promotes, advises, and works with the people of the country who do own the property and who go into the business of assembling a product, selling it, servicing it, and selling replacement parts.

As far as what it takes in export—if you do find an opportunity to work there—it would be well for you to refer to the previous chapter on sales. In the main you will need the same personal traits as those needed for work in sales. Above all it would seem that you need to think as a true citizen of the world might think—in terms of tolerance and appreciation of the ways of other peoples. A real respect for the cultural heritage of Asia and Europe should help.

Without doubt, the men of industry from our own country who represent the traditions of a democratic way of life have both a chance and a duty to so conduct themselves that they will win not only the respect but also the liking—the esteem and affection—of people from other countries.

It has been pointed out by many that all people are nice if you're nice to them. A man working in export should try to be forewarned and therefore forearmed against a provincial, noncosmopolitan fearfulness of men whose skin is of a different color, whose clothes and customs are strange to him.

If the American export man is defensive and stand-offish, it will be quickly felt by his new neighbors. He should approach the meeting and entertaining of his foreign associates with a true understanding that they are fundamentally the same kind of human animal that he is. A genuine warmth of manner, leading to a growing friendship, will soon show him how alike are all members of the human race in their ideals, aspirations, appreciations, and emotions. It will also cement those bonds of faith and understanding between peoples which will lead on to cooperation in their business, cultural, political, and personal affairs. And such working together, with affection and trust, is one of the actual steps on that long journey toward an enduring peace among all nations.

The working life of a man who heads up for a corporation the vast responsibilities of export provides indeed a challenging and colorful top career—a sort of eagle at which you might be hopefully aiming, in your mind's eye, while you kept on hitting the sparrows by way of meeting foreign guests, copying foreign orders, and studying foreign duties and taxes.

Part of the adventure or romance about industry comes from the fact that there are no hard-and-fast rules about the exact trail you must follow in climbing up to the top of the mountain. There is no one pattern for building a career. It is true that you may get there in many ways, but it is also true that you must always *work* your way up to one of those top-flight careers. You can't—much as a daring, impetuous youth would like to—fly over the top and be parachuted down.

A well-known leader in export, a vice president of one of the country's foremost corporations, said that he loved to talk about his work, for it was also his hobby. The skillful, brilliant way in which he pointed out the root of the main problems in export; the fact that he made his job, which is impressive in range and responsibility as to both money and the corporation's reputation, seem like the ingenious, horse-sense performance of a simple Yankee trader; combined with the display of tact and diplomacy of a sort of company good-will ambassador, would make one think he had spent his whole working life studying export. And in reality he has spent the greater part of his working life giving to, staying with, and growing up in the manufacturing end of industry right here in the United States.

But when he was suddenly faced with the reorganization and over-all supervision of export, he had learned so much of how to get teamwork in production, how to cut corners in time and money, and how to deliver the goods on time and as ordered, that he could call on his thorough grass-roots knowledge of the industrial process when he began to figure on how to build up a foreign market. He knew what he was about when he promised in Russia that certain changes in specifications could be made at such and such a cost in Detroit.

When he collected all the firearms he could, from his duck-hunting and deer-hunting friends, to be rushed to England in that desperate time when her need was so great, and when he took the rare wines of France as pay for motors, he was simply meeting emergencies in the same way he had always met them—as he had when he was cutting red tape and rallying his associates to get the "bugs" out of a new-model car and meet production.

His policy in export is never to jam down the throat of a foreign country the ideas and inflexible products of Americans. He defers to the traditions and needs of a foreign people and graciously shapes his own ways, and as far as possible his own goods, to meet their wishes. He deals in facts and straight-shooting plain talk, and before long he's dealing more and more in the far-off places of the earth with friends.

When the man of whom we write left an eastern college —the "effete east"!—he asked for the toughest and dirtiest job to be had in a factory at the foot of the ladder so he couldn't be fired down any lower. They made him a puddler in a steel-rolling mill. He literally came up the long, hard way.

But that was many years ago, in the earlier days of industry. This man has two sons. They went to the same college he went to. And when they were through, did he plan to make the way easy for them—to put them in a junior executive's job with a big office, a big desk, a plush rug, and a set of push buttons to summon a trained staff?

This man is very, very fond of his sons—naturally he loves them. So he said to them, "If you will give seven years and all the hard, steady work you're capable of giving—under orders—and stay with it until you've really got the fundamentals, then you can begin to think about what you'd like to do in the whole scheme of things. You'll know industry and you can pretty well write your own ticket."

Some of his associates might add a proviso. They might put in one more point beside the right attitude, the broad

experience, the hard work. Speaking to this vice president's sons they might say, "If you've followed your father in spirit and character and if you're half as good a performer as he is, *then* you can *begin* to write your own ticket."

It's no ordinary feat to build a really top career in industry. In the future you may not find in these United States so many men who make fortunes so quickly. But one thing that will still hold true has been put in simple fashion by one of the keymen in a plant. He says, "Take each one of those fellows up at the top, and you'll find he has something that makes him stand out, something that even the best of the usual leaders don't have. He'll have courage and common sense and a capacity for hard work. But he's sure in addition to have some special faculty, to be a record-breaker in one particular line. He'll stand out above the rest like one tall tree in a forest."

ACCOUNTING

BEFORE you begin to think about the accounting department we want to recommend to you a book called "How We Live," written by Fred Clark and Richard Rimanoczy.[1] The reasoning behind this recommendation follows. If you are going to be realistic about the kinds of jobs to be found in the accounting department in a big industrial corporation you will find that only about five per cent, say 150 men in a department numbering 3,000, become heads of divisions or supervisors; and only one man becomes assistant to the comptroller; and above the comptroller it takes only one man to be a vice-president or the chairman of the finance committee for the board. And a company appoints only one man as treasurer. The other 2,846 are clerks of various classifications. And you will also find that it will probably take from seven to ten years to learn enough to be eligible for supervision in the accounting department.

But if you are one of those rare individuals, anxious to work and to learn, who is bound to be a top man in the accounting department of some corporation, and will, if necessary, start as even a messenger boy and begin giving, staying with it, and growing up (the essentials in building a career anywhere in industry), we believe that you should get a straight and uninvolved picture of the fundamentals of economics. The book, "How We Live," will give you such a picture.

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[1] Published by Van Nostrand Company, Inc., New York.

The authors have no axe to grind. They have written merely a primer which tells you the story of how work grew from a crude tilling of the soil into the organization of big business. And this information you will need as a foundation for further study of money—taxes, costs, risks, prices, profits, and so on. For if you go to the top in accounting your working life will deal with such things.

Now let's go back to the question of the 2,846 clerks. The classifications we spoke of (there are six in the company we have in mind) have to do with their rates of pay. But the rates of pay, meaning five possible salary promotions, also mean, just as we've seen before, a promotion in responsibility. Do you remember the machine operator who said he didn't want to be a foreman, the extra money wasn't worth the extra "grief" to him?

To some of you the learning of new processes in accounting and particular company methods, all of which goes with a more complicated clerical job, is only "grief" while to others it would be pure joy. Whichever type of individual you are, you can be valuable to industry and there is an important and necessary work for you to do as a part of industrial enterprise.

The essential for a young man or a young woman who wants a job in accounting is a liking for arithmetic—if you don't like to work with figures you'd better stay out of accounting. And in the main, in this day and age, you should be a high-school graduate.

At the risk of repetition we hint to you again that the first requisite for success in industry is character. Honesty, loyalty, reliability, and ability to cooperate are such a "must" that we can take character for granted and go on from there.

The next point in what it takes to be a member of the accounting department seems to be perspective. By that we mean that you must see your rather "broken-down" or circumscribed work—detailed, often monotonous, and continually repetitive, but also demanding concentration, painstaking carefulness, and accuracy—as a useful fraction of a whole unit. And, being mathematically inclined, you are bound to know that each fraction must be there and exact in itself in order to make up a whole.

For a person whose personality traits point to the choice of a roving or active rather than settled or static job; to an interest in general, over-all ideas rather than in specific, precise details; to outdoor rather than indoor occupation; to adaptable, persuasive, human-relation contacts rather than concentrated, steady, routine paper-work duties; to curiosity and persistence in solving mechanical problems rather than curiosity and persistence in working out puzzles in figures; to the taking of chances and making of snap decisions rather than to the conservative, deliberate weighing of many factors and the arrival at discrete, well-calculated conclusions; for such a person, we say, the career which may be slowly and soundly established in the accounting division of industry will hold neither allure, charm, nor fascination.

Through rigid self-discipline such a person may perform the details of his work satisfactorily. But if he has no liking for any of the clerical jobs that he does, no flair for figures and accurate computations, he is bound to look upon his work as so much drudgery. He may even fight it within himself and become either a morose, defeated neurotic or a first-class example of a frustrated, griping, grousing, grumbling, old misanthrope. Ten to one he'll be a malcontent and a trouble breeder. In kindness to him and his associates he should be transplanted into better soil for his growth.

However, to the man whose talents point to an instinct for sifting, sorting, checking, analyzing, and balancing figures, plus a liking for the static, indoor, routine, specific, and soundly established work involved in accounting, there will be only a wonder as to why others so resist the processes and principles which he devours with a keen appetite.

Of course it is this latter type of man who has the best chance to move up to supervision and perhaps more responsible work in finance. And when he approaches the more imaginative, aggressive, and judicial side of accounting, he'll carry with him the ingrained, scientific training which compels him to go just as slowly and surely and get the facts just as accurately when hundreds of millions of dollars are involved in an annual financial statement as he did when 35 cents overtime pay was concerned on a monthly pay roll.

Many big industries hire outside agencies to do that part of their accounting work which requires the knowledge of certified public accountants.

And many top men in accounting in industry are not ready to employ university graduates from the schools of business administration to start in at the lowest-paid clerical jobs and learn the work of their department from the ground up, feeling that college men too often are like prima donnas who are inclined to think they know it all and expect preferential advancement. This attitude on the part of a college man will kill his chance of making good in accounting. However, these top men are ready to accept the college men who will start from scratch and learn the business as slowly and thoroughly as their own industrial experience has taught them it must be learned. Many executives in industry say that a basic knowledge of accounting is an excellent prerequisite for managerial positions.

In general the work in accounting includes the keeping of records of all the financial activities that go on. Some reports are made daily, such as the timekeepers' records, whereas financial statements are made monthly and annually. Bookkeepers record and prepare statements of expense and also maintain inventory controls. Pay-roll clerks compute pay rolls and pay employees. There are traveling auditors who check the accounts of company vendors. There are clerks who check and pay the invoices or bills from vendors. There is a whole division to look after company work orders, that is, to record the money spent for tools and for depreciation on the investment. There are people to watch costs—to keep track of all the cost of material, labor, and overhead or burden.

A big job of accounting has to do with preparing a company's tax returns and reviewing them with the government agencies. Another most important job concerns the setting of the price on a product; the data are first obtained from cost estimating but they are brought together and further analyzed by the accounting department before the final price is set.

Of course a vital job for a top man in accounting is the securing of credit and the far-sighted planning, budgeting, and balancing of the entire financial structure of a corporation.

Very few of the men in accounting, even at the top, are what the public thinks of as Wall Street financiers or promoters of stock buying, but Wall Street, we have found, appreciates these men. We are going to give you the story of one man in accounting whom the head of the New York Stock Exchange proclaimed as one of the very soundest financiers connected with industry in the United States. This is no mean distinction.

And right here we should tell you that the government, too, appreciates the outstanding heads in accounting, for this same man has a letter, of which he is justly proud, from the Comptroller of the Treasury. It was written at the close of negotiations carried on during the banking crisis. The comptroller wrote: "My experience in the years gone by is that when men are anxious to accomplish a common purpose, both with honest motives, misunderstanding vanishes when they look at each other and discuss the matter frankly. Thank you for your visit."

Since we can't use the real name of this man who has allowed us to tell something of his career, we will call him Bill Farley.

THE CAREER OF BILL FARLEY

Bill's first work was diving into the river for small change tossed out by the people on pleasure boats. Our first glimpse of him is when another young lad comes running down a dock along the river front calling to him, "Hey, Bill! It's Doc Jennings' boat—oh, boy, didja see her catch the wind! Gosh, she's fast. An' Doc's the skipper today. Gee, that's swell for us; betcha he tosses two bits every time.

"You know the skinny guy sails her sometimes? He was in here Sunday—the time you was up at church—an' he never tossed nothin' at all but pennies. Some dame threw a dime, 'cause she said it would be harder to find, being as it's smaller. There was a big crowd—all of 'em rich, I'll bet, an' they never thought a thing about the money end o' this show. 'What a lark!' one of 'em says, and he holds up a penny an' he says to me, 'Fetch it, boy,' an' then he throws it way in under the wharf.

"Gee, some folks make me sick the way they think this swimmin' and divin' all day long is just fun fer us; they oughter know about the doctor's bills I'm helpin' my old man pay. An' your mother don't have it so easy with four kids to feed since your dad got 'lectrocuted. We oughter tell 'em, Bill. But Doc Jennings, he seems to know more'n those other swells. C'mon, Bill, his boat's coming about to make *the landing—we'll split the take fifty-fifty an' that'll be fair* for your mom and my dad both; whaddayer say, pal?"

It may well be that ten-year-old Bill Farley began to learn the trick of sizing up folks as well as how to stick at a job from this, his very first money earning.

Helping out his mother, he found all sorts of ways to pick up money. Three days' work in a butcher shop when he was eleven brought in the family's week-end meat.

Being fired from a newspaper—not for killing off President McKinley prematurely, which he did when he fell for a false news-report and rushed out an extra which had to be recalled (this may, by the way, have taught him a lesson in verifying the facts, a lesson he certainly never forgot), but being fired for joining a union—was a feature of his early career. Bill didn't retract about the union; he believed in his right to join. He stood his ground. And he was fired.

Starting out in factory work in the shop, young Bill forged ahead. He became a foreman. He saved his money. He got married. He and a friend took their savings and with a little help started their own metal-spinning company.

As a very young man Bill Farley, you'd say, had built his career, for all was going well with his venture. And then fate took a hand in the game. An employee, through his own carelessness, lost his hand in a machine. A lawsuit was started against the company; while it was still unsettled, Bill was forced to undergo a major stomach operation. When he left the hospital, on crutches and in a cast, he found a sizable judgment must be paid the worker. Bill had to sell his business and mortgage his home.

Suddenly he was broke, crippled, and out of a job. But although he was overthrown he wasn't defeated. He went out and found himself a sitting-down job in cost accounting with a big automotive company.

By a happy stroke of fate he had found a place where his natural talents were marked. He discovered that he had a flair for figures; they intrigued him. With his character, of course, he would have worked hard at any job. But in this business of accounting he *loved* to learn. He went to night school and spent his holidays studying money and figures. And he was so good in the school work that after he graduated the school made him a teacher. It was then that he really did learn—in his night teaching, according to Bill. But for every bit of his book knowledge he found the application in his factory work. It was a first-rate example of co-operative education in business administration.

The upshot of it all was that Bill Farley went up the ladder in accounting in the automotive company where he had begun sitting bolt-upright in a special chair and only able to move his arms and his pencil over a limited range. He was eventually freed from his cast and able to walk around. The company made him a paymaster—"Ketchum Pay" is what the boys called him. And he came to know those boys—most of them to call by name and many of them to slip a loan to, for they began going to Bill with their troubles; he was that kind of a paymaster.

Being overthrown halfway in his career, being crippled, being up against it, had still further sweetened the sunny, friendly, humorous nature of this Irish lad with a genius for figures and a genius for friendship.

So he went along to the next round and was assistant cashier, and then up another step to assistant treasurer, and finally he reached the top in accounting. Sixteen years after he had started as a clerk he became the treasurer of the company. But remember that he had already learned shop work and made himself into a teacher of finance, and remember too that he had proved to others the value of his courage and his frank and fearless honesty. Eight years later he was both secretary and treasurer of the company. Twenty-four years later he became its vice president.

And there he is today, laughing off his success; minimizing what he did in the banking crisis to help his city and the nation; talking more about his sons' abilities than his own; never mentioning his close friendship with Father Flanagan of Boys' Town, or his being at one time a handball champion, or his playing the piano with Gene Buck; and saying nothing about his chairmanship of countless community activities for civic welfare.

We don't believe that Bill Farley actually thinks in terms of civic welfare or philanthropic donations. He thinks about spontaneous, happy, human relations with his fellows; and he loves to help people along, even though he calls it just helping *things* along. Perhaps it is this delightful twist of mind which has always helped *him* along, plus the fact that his work is his hobby and he's always himself, without front and without strain. For this man in accounting, Bill Farley, is one of the best living examples of what it takes to build a career in industry. What he says himself about his working life is, "Heavens, I only did what I had to do—nothing wonderful about *my* career." But then, like the other genuine leaders, he's not much given to boasting, he's still too busy living.

SUGGESTED READING: "Accountancy as a Career," by Lawrence W. Scudder, published by Funk & Wagnalls Company, New York. 1939.

THE WORLD ADVANCES

New times demand new measures and new men;
The world advances, and in time outgrows
The laws that in our fathers' day were best;
And, doubtless, after us, some purer scheme
Will be shaped out by wiser men than we,
Made wiser by the steady growth of truth.

We cannot hale Utopia on by force;
But better . . . be at work . . .
Than in a brute inaction browse and sleep.

No man is born into the world whose work
Is not born with him; there is always work,
And tools to work withal, for those who will;
And blessed are the horny hands of toil!

The busy world shoves angrily aside
The man who stands with arms akimbo set,
Until occasion tells him what to do;
And he who waits to have his task marked out
Shall die and leave his errand unfulfilled.

Our time is one that calls for earnest deeds.

The time is ripe, and rotten ripe, for change;
Then let it come; I have no dread of what
Is called for by the instinct of mankind.

The future works out great men's purposes;
The present is enough for common souls.

—JAMES RUSSELL LOWELL,
"A Glance behind the Curtain." [1]

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[1] Reprinted with courteous permission of the publishers, Houghton Mifflin Company, Boston.

Part III - - - - - - - - - *Chapter 22*

INDUSTRIAL EDUCATION AND TRAINING

WHAT IT TAKES

TEACHING is a profession and industry is a business. It takes vision and courage and persistence to be a teacher in industry.

To be a trainer is a different matter. You can train apprentice boys in skills and habits and information about machines. You can train all kinds of employees who will go to factory-conducted night classes to learn all kinds of things relative to industry—drafting, accounting, even special phases of engineering.

As a trainer of men you can sometimes leap into the breach when there's a dearth of qualified inspectors and turn out in a few weeks—from a miscellaneous selection of men who never touched a micrometer or gave thought to a blueprint—a well-groomed crew of satisfactory performers, who can walk right out and adequately do the job of inspecting. You can do these things and know that you're a good trainer, and, as such, have met a specific, immediate need in industry.

But how about this broader job of teaching, the job of industrial education? What does that require? In the following outlines we ask a man to possess at the start a mechanical aptitude and interest, earn a college degree in education, gain actual teaching experience and even administrative experience in schools, and then apparently start all over again to learn about industry. How, you ask, can so much background be justified? How can this professor, this academic personality, fit into or be of any use in the complicated picture of industrial progress?

The question seems well pointed; the keynote to the answer is in that last word, "progress." Wherever it exists as a growing, progressive enterprise, industry will turn to any of the professions—to medicine, to law, to education—which can help it to grow. You saw indications of this in the chapter about specialists.

We shall not discuss in this book the extent to which industry has found it necessary to call on the profession of law to help solve its problems. Nor shall we discuss the extent to which the medical profession is being called on to further the physical welfare of employees. We shall stick strictly to the relationship of industry and education. However, it is significant to remember that Yale University recognized the tie-up of many professions when it called them all together for the experimental program of the Institute of Human Relations. Integration as well as cooperation of the efforts of all of us, professional people and business people alike, for the good of man and society, is bound to evolve as time goes on.

A real educator in industry is a pioneer, and no pioneer was ever completely sure and safe. Security in this our hazardous world, someone has recently said, can only be found in a jail. But rocket and atomic bombs are certainly no respecters of jails. So until some of these dreamers, these pioneer thinkers—in a word, educators, in fact if not in name—find the road to peace, it is obvious that none of them—or of us—can ever be completely safe.

The engineers and the scientists can startle us and increase our material comfort with inventions. But the instilling of a sense of values, the teaching of how to use all these tools wisely, is a problem in education, in human relations.

Education is a thing that goes on all through life. You get it best through experience. In fact, one of the directors of industrial education in discussing it with us reiterated the truism, "There is no substitute for experience." Incidentally, about training he feels that the best is the least, and that in many cases in factories the necessary training can be taken in stride.

Now if education ought to come with experience, that fact can give us our first cue as to this art of teaching. It is primarily a matter of setting up for a student such carefully planned sequences of experience that he is stimulated to develop to his full capacity; and that he is never frustrated by being forced into a situation, or we'll say an experience, such as having to solve a mathematical problem, beyond his present power to digest.

Along with this meaningful, carefully selective process—rather highly individualized—of luring and leading and steering a man into educating himself, there are bound to be both end products and by-products. In purposive teaching, in response to a felt need, the much-sought-after end product is likely to be the improvement in attitudes and aims and morale, those intangible things in a man's personality; the by-product may be the learning of certain facts about algebra.

In less wise teaching, where a man is not skillfully led but is forced or compelled into a lesson, the end product may be an excellent memorizing of the facts about algebra, but if the teaching has been full of domination the by-products are likely to be the building up of some unhappy attitudes—of resentments and even open antagonism toward self-development.

We shall take for granted that you—since you are reading these words—are interested in the world of industry. But are you really interested in the hard, often baffling, and always responsible career of teaching? That question is the primary, all-essential query which you must face if you wish to be a member of a progressive department of industrial education —one with high standards. (Remember the distinction between industrial education and the more immediate job of industrial training.) But what *does* it *take* to be a teacher? Well, to put it bluntly, you must see the other fellow's interests as though they were your own, and you must find your main reward in building *him* up. Just as a real doctor is ready to get up and travel a great distance in the middle of the night to care for a very poor patient who may never pay his bill, you as a teacher must be ready to spend time and effort in planning better methods, in coaching individual students, and in seeking to further educate yourself—all without thought of recognition in either words or money.

When we wrote about a toolmaker we tried to picture for you an ideal toolmaker. We can do no less in picturing a teacher. Socrates is the classic example about whom most of us know. But, happily enough, right in our own lives we can often think back to a man or a woman who has taught us more than the facts or the information he or she was imparting, someone who "got under our skin" so that we went out and did better than we'd known we could do.

The person who has that great gift of both improving our knowledge and skill—developing our abilities—and of inspiring us to work toward higher purposes so that we actually *do* so is, wherever you find him and whatever his title, a teacher. You will note that the mere exhorter, cheer leader, emotional-ballyhoo clown, does not fit into such a strong and forceful picture. In fact the real teacher is often so gentle and self-effacing that you hardly realize at the time how beautifully and skillfully he is moulding the human clay which is you.

The work in industrial education, like the work in personnel, should be an art. And so it is, whenever and wherever you find men on the job endowed with creative power to handle human relations. It is no mean task you undertake if you start in such work. But then it is no mean reward—for that real teacher who becomes truly a builder of men.

It seems to us, as we think back to one such man, that he never stopped long enough to ponder about his own feelings to put into words the kind of reward his career had given him. If we had tried to drive him to do it he might have balked or stalled us off by teasing or telling a funny story. He wouldn't have liked the idea of sounding off about himself. But if we had hung on and finally persuaded him into thinking of it, with the serious plea that it would help *us* if we could know, we can guess that he might have said, "Be a real teacher? Be—how was it you put it—a builder of men? Well, a person just keeps striving toward that; what you do is to kind of steady a fellow on his own feet so that he does his own building. But I know what you mean; if you really, once in a dog's age, *did* do a good job—turned out a real success—why, then I believe you'd feel 'greater glory hath no man.' Now run away and leave me—you're a nuisance."

HOW IT OPERATES

"I will prepare myself and sometime my chance will come."

—Abraham Lincoln

INDUSTRIAL EDUCATION

Education takes a long-term view. It is sometimes defined as the integration of personality for social efficiency. Other definers say education is preparation for life. But still others, with greater vision, say education *is* life.

INDUSTRIAL TRAINING

Training takes a short-term view. It is the process of imparting knowledge and of guiding practice so that skill is acquired. People come into industry with varying school experience. Training should, therefore, be supplemental, based on findings about individual status. And it should be sharply pointed and accelerated to meet the immediate, specific need.

PROMOTION

In industry training does not guarantee promotion. It is realistic for an industrial employee to understand that "the breaks" play a part; the man directly above may die suddenly or he may move up; on the other hand, he may live longer than you and never move up.

Changes in policy of top management or changes in top management itself may affect promotion. The total economic situation—booms, expansion, depression—will tremendously affect an individual's progress.

However, with all good concerns, merit and ability, together with maturity, precede seniority in the matter of promotion.

ORGANIZATION

The type of program in industrial education and training varies with the policies of management and the size of the company. In general, all companies agree on a four-year apprenticeship for machinists or skilled tradesmen. In the more progressive of the large corporations the program includes:

1. Institute of Engineering Courses. (For graduates of schools of engineering. In one case the master's degree in engineering may be awarded.)

Special courses in engineering and industrial subjects given as night-school courses for company employees.

2. Supervisory Training Conferences.
   Pre-foremanship conferences are included.
3. Special-group Training Courses.
   Engineering-technician training for women; basic clerical training; beginning courses in inspection, are typical of these courses.
4. Apprenticeship Training Courses.
   For job setters, machine repairmen, inspectors, skilled tradesmen (tool, die, and patternmakers), and production specialists of any kind. In one case these courses are carried out as a high-school cooperative program—see chapter on "The Schools and Industry."
5. Business Training.
   A full-time two-year program on a college level is carried on by one industry.
6. Training of Sales Executives.
   Varies in amount of time allowed and type of course. Most companies stress a course in psychology of selling.
7. College Cooperative Courses.
   Where conducted, these courses are in connection with accredited colleges or universities. There are two-year and five-year programs in business administration, and a three-year program for technicians. (Degree for five-year program.) A five-year program in engineering or in junior executive training—see chapter on "The Schools and Industry."
8. Special Courses.
   a. One organization offers a one-year adult-training course for college graduates both within and without industry who will become junior executives. Suitable industrial experience is accepted in lieu of college graduation.
   b. Industrial Teachers' Training Courses.
   A one-year program for teachers and school administrators who will become teachers in industrial education—either technical instructors or educational supervisors.

c. Special Veterans' Training Courses.
In cooperation with the Veterans Administration policies. This program is individualized. It varies from a three-months orientation course to a four-year program or a five-year program if a degree in engineering is obtained under the college-cooperative plan.

d. Liberal Education Courses.
In one case a corporation is sponsoring, as part of their night-school program for company employees, a wide range of cultural and informational courses such as music appreciation, gardening, art appreciation, world horizons, and feeding the family. Another corporation has a program for sons of employees to stimulate homework for junior craftsmen.

In general there is no doubt that industry is increasingly aware not only of the tangible, immediate value of specific training to improve work efficiency, but also of the less tangible but unquestioned value in the extension of employee education, reaching from unskilled newcomers to able and experienced executives. For education is literally the "leading out" of a man; and within most of us lie uncharted depths of appreciation, understanding, and capacity for a wiser and more useful life.

TECHNICAL INSTRUCTOR

I. Duties

A. Conduct classes in technical subjects or manage and instruct in the machining department.
B. Prepare and administer technical tests and examinations.
C. Make full use of visual aids to assist in quick comprehension and rapid learning.
D. Develop a practical application of education to the industrial situation. This includes the meeting of production schedules in the machining department.

E. Carry on effective selection and guidance by means of standard and special psychological tests to determine aptitudes, qualities, and attitudes.
F. Give individual counseling to develop a well-integrated personality, able to function harmoniously with others.
G. Improve and perfect teaching techniques and put into practice new methods which he or other members of the profession may be developing.

II. WORKING CONDITIONS

General machine-shop conditions, or a classroom.

III. QUALIFICATIONS

A. Education: Degree in education from a college or university. Emphasis on mathematics and science. Three to ten years of general teaching.
B. Training: Experience plus adequate industrial experience. The latter is sometimes obtained through a special adult-training program of one- or two-years duration.
C. Before acceptance as an experienced teacher in the department of industrial education, a varied time is needed, depending on individual ability, adaptability, and the needs of the particular industrial situation.
D. Physical: Good health, insuring regular attendance to meet both class and shop schedules.
E. Aptitudes: Mechanical ability; scientific approach; teaching ability. Interest in developing and promoting another person's capacities, mental and personal.
F. Personal: Orderly, systematic, well-balanced and effective way of performing. Patience; persistence; adaptability; vision.

EDUCATIONAL SUPERVISOR

I. DUTIES

A. In general the duty of an educational supervisor is to impart reliable information, improve attitudes and morale, and instill supervisory skill. This involves:

1. Conducting supervisory training conferences which are consistently stimulating and informational. Securing willing attendance and enthusiastic participation by supervisors is a major part of this duty.
2. Making contacts with supervisors in their departments to determine to what extent they are utilizing their supervisory training.
3. Guiding and assisting individual supervisors in the application of their supervisory training to their own particular problems. In some cases this involves a trouble-shooting type of counseling carried out under direct orders of the plant manager.
4. Utilizing and adapting all training techniques designed to successfully meet the general aim or duty as stated.
5. Cooperating and coordinating his training with the work of all departments in the plant to further the general aims and policies of management. Planning special conferences on such subjects as safety is an example.

II. WORKING CONDITIONS

His own office, conference room; periodic visits in shop atmosphere.

III. QUALIFICATIONS

A. Education—Desirable: Master's degree in education, with some of the college training in engineering subjects.

B. Training: At least three years of successful teaching and educational administration. At least two years of successful industrial experience, preferably with some supervisory background.

C. Experience: In general, two years of practice and guidance in the use of techniques peculiar to supervisory training is required to become a well-rounded educational supervisor.

D. Physical: Abundant physical energy in addition to consistently good health. A clear, pleasing voice that will "carry."

E. Aptitudes: Ability to analyze managerial and supervisory situations. Ability to express himself forcefully and in such a way as to hold interest. Ability to make accurate reports. Above-average intelligence.

F. Personal: A likable personality. Ability to develop confidence. High degree of reliability in exerting a constructive, harmonious influence with people.

PERSONNEL

WHAT IT TAKES

THERE is a familiar story about an old darky who was up before the judge. He sat obviously dozing off while his lawyer expounded with great oratory, insisting that his case involved a question of tact. There was a slight snore from old Nicodemus, so the judge suddenly interrupted. "See here," he said, "your client doesn't even know what tact is. Do you, Nicodemus?" "Yes suh, Jedge, yes suh, Ah knows what tact is." "You do? Well, do you know there's a difference between courtesy and tact? Your lawyer says you do. Now do you?" "Yes suh, Jedge, Ah knows dey's a difference," says old Nick, now wide-awake, "and Ah can prove it to you, Jedge. You know, suh, Ah's a plumbah; an' one day Ah gits a call to go up on de hill, up to one o' mah regulah customahs, so Ah figguhs it's de same old trouble. An' when Ah gets up deah to de house Ah goes right along up to de bathroom wheah Ah's suah it needs fixin'; and Ah see de doah's closed, but Ah open dat doah right up; an' you know, Jedge, Ah see dey's a *lady* in de tub. Well, Jedge, Ah close dat doah awful quick an' ah says, 'Excuse me, suh!' Now, Jedge, when Ah says, 'Excuse me!' dat's *courtesy*, but when Ah says '*suh*,' dat's *tact*."

The one and only man in a large personnel division who talked about how good he was and how splendid were his techniques and his skills in handling the personal problems of people in the plant, was the one and only man of that division who, when being quizzed and probed for the purpose of getting facts, failed consistently, in little and in big ways, to live up to old Nicodemus.

So it goes without question that those men who make their living and build up their careers around work in which the human element is the main concern must be men outstanding in diplomacy, men not only of courtesy but men also of tact.

You may become expert through diligence, hard work, and cleverness in all the mechanistics of employment procedures, the latest and the most complex. You may fire battery upon battery of tests; you may devise system upon system of constantly revised job evaluations; you may sort, screen, classify, and revise record upon record. You may use speed-up methods, tabulate by machines, give group inductions, moving pictures, and even individual chairs and ash trays to prospective and newly accepted novitiates in industry. All this will be splendid; you'll be progressive and in many ways efficient. Good organization will undoubtedly pay dividends in weeding out undesirable applicants and in handling effectively the business of hiring, transferring, laying off, promoting, and discharging employees.

But if that is all you can manage to be—an expert in the mechanics of the job—you'll never be a top-notch personnel worker in a good concern. For personnel work is an *art*. No one has yet advanced—or retarded—it to the level of a science. It is not always practised in its highest form, but when it is so practised it is an art. It demands a sensitive, imaginative, intuitive person to deal constantly with variables. Human beings are involved, dynamic variables. The ability to deal in intangibles, to get results through sheer brilliance of maneuver where many fluctuating, touchy, peppery, and often insecure personalities must be harmonized, is a necessary function of a successful personnel man.

Along with this flair for dealing smoothly and effectively with every conceivable temperament and with every one of a myriad moods, a personnel worker must possess other key requisites. He must know corporation or company policies and procedures and follow them. He must know the shop and all other departments from the point of view of a thorough job analysis or job evaluation. He must be analytical, quick-thinking, and versatile. He must have excellent judgment and a fair, impartial objectivity. He must have discretion and balance and emotional poise. He must inspire and deserve confidence and trust. He must have humor and flexibility. And above all he must have a genuine satisfaction in giving service. And when things go wrong with one person after another he must not only take it, he must take it and like it —like it because he does something to help each person help himself. And like it because he does all he can to set things right in the environment around that person.

Now there seems to be evolving in the personnel field a new type of trained worker. Interestingly enough, the example we shall use is a woman. She has in full measure every one of the key requisites. In addition she has thorough training and broad experience in psychiatric case work. At the present time she has spent eleven years with one of the very best industrial concerns, in charge of the work for women. During her first three or four years with this company it was a carefully guarded secret that she knew anything at all about psychiatry. She deliberately saw to it (and still does see to it) that she never let slip a technical or psychiatric term or word. But she practised her diagnostic skills. She got at causes. She caught the straws in the wind and prevented emotional flare-ups. She anticipated crack-ups or nervous exhaustion and she detected functional illnesses due to tensions and strains. She knew signs, storm warnings. She is doing an excellent job with untold numbers of unhappy, sick-at-heart employees. There has been no publicity about her doings.

Somewhat in contrast to this new type of worker is a man who has spent about thirty years in the service of people in personnel work in industry. This man has had no theoretical training of any sort for personnel work. But he is undoubtedly a "natural." He has rehabilitated more people through his friendly, perceptive, golden-rule, building-up wizardry than he or anyone else can ever count. His influence is tremendous. His admirers are legion. The qualities in common, aside from spontaneity, humor, and humility, with which these two workers in personnel seem blest, are complete genuineness and indestructible faith in people. If you were a little child, or if you were only a dumb animal, I believe you'd sense it as you came near them.

The standards as to personality; character and successful experience in human relations for those who contemplate personnel careers are, as you see, very high. The standards as to previous schooling, knowledge of this or that subject, are not fixed at all. You won't become a leader or a successful worker in personnel without learning the ropes in the industrial situation. It will take you many years. It's a long and tortuous road, and you'll have to earn the respect of your associates and superiors every single step of the way.

Don't let us discourage you if you have what it takes. But old Nicodemus, our tact-and-courtesy "plumbah," was a mighty smart old darky—and that's only the start!

HOW IT OPERATES

The division of personnel is organized in various ways throughout industry. We shall select a plan used by one corporation so that you may have a well-rounded picture, but remember that you will find differences with every company. In the organization which we have selected, labor relations, industrial education, and medicine do not operate under personnel. Under this selected plan the personnel division is made up of the following:

I. Central Personnel: A director and his staff responsible for the carrying-on of all personnel work for the corporation as such—all central bureaus—and for the supervision of all personnel work in individual plants
II. Central Insurance: A central bureau with a representative in each plant
III. Mutual Benefit: A central bureau with a representative in each plant
IV. A group managing stores located in each plant and operated for the convenience of workers, in which the profits are used to help needy employees
V. Legal Aid: A central bureau
VI. Compensation: A central bureau
VII. Safety Departments: One in each plant
VIII. Employment Departments: One in each plant
IX. Miscellaneous: Magazine, recreation, and special group activities

The central insurance staff consists of an insurance representative of the national company with which the policy is written, who is paid by that insurance company but who works in the central insurance offices; a supervisor of the central bureau; an office manager handling the insurance details, stationed in each plant; and various clerks, typists, stenographers, and secretaries to carry out the necessary record keeping. Reliability is essential for the staff responsible for protecting people against financial worries and extra hardship in time of trouble—when serious and prolonged illness comes, or when death itself takes a man from his family.

The mutual-benefit staff consists of a supervisor and assistant, both of them men, in charge of a staff of about fifteen visiting workers, all women. These workers are a group with varying background. Many of them are nurses, some have had social-service training, some have been workers such as secretaries in the plant, some have had a liberal-arts college course. They should all be considered as good "personnel" workers. Every day they accept assignments, each for his own area of the city and environs, to make a home call on employees who have been absent for more than three days. For this work they use a company automobile. They travel through rain and cold and snow and heat, and they do an infinite amount of good. They not only report to their superiors and to the plant supervision as to the cause of absence and the probable date of return; they also "size up" the home conditions from the point of view of giving assistance through referring workers or their families who need help to the proper community agencies; they bolster up the morale of the employee, see that he gets his insurance benefits, and as far as possible see that he gets advice and assistance in securing proper hospital and medical care. All this involves great tact, sympathy, and skill in human relations.

The group of visitors from mutual benefit was, under emergency wartime conditions, tremendously hard pressed, and much of this excellent build-up and highly personalized aid to employees became impossible, owing to the pressure of time and numbers.

Studies are made by mutual benefit of the relative amount of absenteeism among different groups and also of its causes. People, they have found, often develop illness as a neurotic symptom, and a worker who is chronically absent should be considered from that point of view. In general, those who are absent for less than three days report that they are "sick." And these experienced personnel workers agree with a well-known man who said, "No doubt the employee *was* sick, but who knows whether he was sick of life, sick of being in love, temporarily sick of whisky, sick of his job, sick of his annoying children, or sick of his income tax?"

The legal-aid department consists of the company lawyer; an assistant (also a lawyer), secretary, and clerks.

The compensation department consists of a supervisor with clerical assistants, one in each plant. He settles accident cases involving payment of compensation according to state laws. He works closely with the medical division and with the safety departments.

The employment departments consist of a supervisor, an employment manager and sometimes an assistant employment manager; an interviewer-qualifier (sometimes an interviewer-qualifier who handles all women applicants); a "labor-control" man, who handles transfers, layoffs, and discharges; a varying number of desk men, who ask questions and fill in forms as to insurance, bonds, and necessary personal information; a fingerprint expert; a photographer; sometimes an outside contact man or recruiter if one is necessary; stenographers, messengers, and clerks.

On the staff of the director of personnel is one man who promotes recreational activities for men and women employees. Competition, particularly in bowling and baseball, is very keen. Recreation, happily and at last, is being recognized as far more than "physical culture." The value of being *recreated* by any hobby—by a game of chess as well as by football, the absolute essentialness of play or relaxation in some form or other for the upkeep of mental and physical health as well as for the social value of group activities, the wisest heads, from the Greek philosophers on through the ages, have always accepted. It would seem that labor-management councils may well consider expansion of recreation—opportunity and facilities for sports, week-end and vacation plans for both winter and summer, rest houses, dramatics, and so on—as a legitimate function of cooperative labor-management action.

Another member of the director's staff organizes and conducts a most successful men's chorus. The annual concert of this group, which is made up from all plants in the corporation, is an outstanding musical event in the community.

Still another staff member, with his assistant and photographer, is responsible for a monthly magazine which tells not only of the engineering feats of the corporation but also of the personal feats of the men and women of the corporation—men and women big and little. This magazine is sent free to every employee. If you have ambitions for a career in journalism or photography and you think you could also become a good personnel worker, here is a means of combining those aims, if you can discover a proper opening.

So this is the work of one personnel division, sketchily presented. But don't study long over a staff for this and a staff for that. And don't look ahead for charts or statistics that show ratios and curves and statements about one messenger for every such and such percentile of people through the employment gate. You won't find them. They're not here. That's machinery; and if there's one place in industry where machinery must never steal the stage, it's in the personnel division.

People will tell you throughout the corporation whose plan we described that there's a great personality behind the good deeds of the good men in personnel. "There don't many come like him," they'll say. "Got more o' the milk o' human kindness in him than any man I ever knew. Why, Jim was saying the other day, those guys running the union they swore they'd shut down every plant in the corporation if the company ever let *him* go. Yep, quite a guy—need more like him."

PERSONNEL QUALIFICATIONS

An honest interpretation of the ideas of the leaders in industrial personnel forbids the writing of an outline giving definite suggestions as to the qualifications necessary for a man or woman who wishes to work in the personnel department of industry.

Personnel work is an art; the successful worker is an artist, and we can't tell you how to school or train him to become an artist in human relations.

Many universities have developed well-rounded training programs in the field of personnel. The best authorities in those universities agree with the industrial experts in the personnel field that students must be given a sort of interneship under supervision to learn how to apply the techniques they have been taught. These authorities believe, as we do, that college courses in personnel, psychology, sociology, mental hygiene, economics, testing, placement, guidance, industrial management, industrial relations, and all sorts of other academic informational courses may be valuable to a person who wants to work in personnel, just as a broad liberal-arts education should be helpful to a person anxious and able to assimilate it, a person seeking help in his lifelong task of educating himself and not seeking merely a degree.

However, knowledge is transient and only wisdom is enduring. To be a real personnel worker you must have acquired through a growing-up process, which generally takes many years of life experiences, that high degree of understanding, tolerance, fairness and kindness in judgment, that genuine love of your fellow man, which, blended together, means wisdom in human relations.

The experiences which lead to such maturity seldom come from a sheltered and safe existence. They come more often from actual combat in the hurly-burly of life; from the sharing of work and play with all kinds and conditions of men, the battling against yourself, the falling down and getting up again—in short, the give and take of a full life in a competitive, imperfect world.

Together with the building of a fine sense of values to help him in dealing with people, a man must acquire a thorough knowledge of the organization of his own company. And the policies of his top management will be his realistic bible of procedure. Each industry must needs secure, develop and hold its man power according to the demands of its own particular business. Expediency will determine some of the compromises a personnel man must make; and loyalty to his company will lead him to build good will wherever he can. The way in which a man has been treated when he couldn't find a job at the employment office will be forever associated in that man's mind with his feeling toward the industrial product of the particular company concerned.

There are workers in personnel who have grown up from clerical jobs; there are those with shop background; there are lawyers, teachers, and doctors who have become outstanding employment supervisors and directors of personnel.

Most of the successful personnel people whom we have consulted feel that a personnel worker must be at least thirty-five years old before he is entitled to a position of any great responsibility.

To those of you who are still in school but who feel that you possess undeveloped talents in this highly demanding line of work we suggest that you go as far as you can in securing general academic knowledge of human relations. We suggest that you enter on a training course to get all the varied experience possible in the industry you have chosen to try to learn. We suggest that you really make friends with as many people as you can. And then we say practice the golden rule; and don't take yourself too seriously—in fact, get out of yourself and inside the other fellow. Avoid like the plague a holier-than-thou attitude, or the impersonal, cold-fish, *unenlightened* professional-social-worker approach, which says, "I can tell you how to run your life as I know it should be run: unemotionally, objectively, efficiently." Be an understanding listener. Never tear a man down but always build him up. Have faith in the goodness to be resurrected in sinners. And then—by the Grace of God—if you work at it and suffer at it, you may, in the course of time, become that somewhat rare individual who gets to be known around a city and around his own company as "pretty good in personnel."

SUGGESTED READING: "Men, Women and Jobs—A Study in Human Engineering," by Donald G. Patterson, John G. Darley and Richard M. Elliott, published by University of Minnesota Press, Minneapolis.

INDUSTRIAL RELATIONS LEADER

How the heart listened while he pleading spoke,
While on the enlightened mind, with winning art,
His gentle reason so persuasive stole
That the charmed hearer thought it was his own.

—JAMES THOMSON

LABOR RELATIONS

WHAT IT TAKES

TO BE an ideal leader in industrial relations, guiding human relationships in a great industrial enterprise, is a colossal task. It seldom falls to the lot of one man to carry so great a load.

In a certain corporation which we have in mind, where 110,000 people work, an executive vice president delegates the work relative to the human element to several directors—one for a medical division, one for personnel, one for industrial education, one for public relations, and one for labor relations. In this case the work of labor relations includes negotiation of union contracts, general supervision of the application of such contracts, participation in settlements of disputes and adjustment of grievances, participation in the formulation of labor relation's policies, supervision of the administration of these policies, and many related tasks.

We are going to try, in this chapter, to bring down to earth, down to specific statements of fact, the answer to that almost unanswerable question, "What does it take, at this time, to be a labor-relations man in industry?"—at this time and in this country. For in this period of our national life we are undergoing a rapid-fire bombardment of the whole industrial-relations problem by agencies of government, including congressional investigating committees; by organizations of manufacturers, boards of commerce, organizations of labor unions, editorial, book, and magazine authors, and the somewhat baffled bystanding public.

Inasmuch as this state of affairs leads to constant change in the situation to be handled—the exact job a man will do—we shall reflect the opinions of many industrialists who have estimated what it takes to work in labor relations according to the particular policies of their own companies.

Under the heading How It Operates at the end of the chapter, we shall report, after the fashion of a brief survey, the various means of handling the whole problem which are now being used by industry, big and little. And the trends toward progressive, forward-looking policies in industrial or human relations will be found in the epilogue under About the Future.

If this platform of ours, stating how we will handle jobs and careers in labor relations, seems to you more like a raft than a solid foundation, you are already getting your first picture of the environment in the field of labor relations. It is not a well-defined field in which if you qualify you will work; it is a relatively uncharted ocean on which you will sail through rough seas and in raging tempests. Moreover, you will often be your own pilot, steering off the rocks and the shallows and probably praying to God that you may hit upon a safe channel to bring you at last to harbor and permit you, for a time at least, to land on solid ground. In fact, when we said to one friend of ours, "Johnny, what does it take to be a labor-relations man?" he didn't hesitate and think back over his ten years on the job. And he didn't stop to light his pipe and stall around while he thought out the exact words to use, as some old-timer labor-relations men might have done. He came back at us like a flash. "Medicine for your nerves," said Johnny. "That's what it takes. Medicine for your nerves and lots of it."

Under the corporation plan we described, the work either as the director or as a member of the central staff of the labor-relations department being considerably concerned with knowledge of labor laws, with the drawing up of contracts, and with the presentation to the National Labor Relations Board or to an impartial referee or to some governing authority, local, state, or federal, of the company's position relative to a major labor dispute, it is apparent that the background and experience of a lawyer is mighty useful.

However, if you are to head up labor relations or work in that department in one of the plants of the corporation, it is a different story. At least a high-school background will be required and a broader school background will be desirable. From then on you should acquire, through several years of experience in the plant, a thorough knowledge of the shop and the whole manufacturing process. Experience in time-study and in planning should be an important part of this training for labor relations. You should also learn all company policies relative to labor matters. This is so that you may, as a labor-relations man, assist in or fully undertake the settlement of grievances without either jeopardizing the company's interests or making promises that may be contrary to well-established policies.

Your training *within* the department of labor relations, if you are considered qualified and appointed there, will include knowledge of the union contract and familiarity with labor legislation from the point of view of rules and regulations in the plant. (Safety laws and wage classifications are typical of these matters.)

So far we have discussed what it takes in either corporation or plant labor relations more from a knowledge and experience angle than from the point of view of your personal traits and aptitudes or interests.

If you think back to our friend Johnny who was ready for nerve medicine, you may well realize that you will need what the psychologists call emotional maturity. The psychiatrists mean the same thing—only more so—when they speak of your "achieving adulthood." And the man in the street might say that you need a cool head, a steady eye, a firm chin, and a stout heart.

The leaders in labor relations in the corporation we have been using as an example of organizational setup might sum it up by saying that in addition to adequate preparation, experience, and knowledge, you will need to be interested in the problems of people, and you must acquire skill in handling adjustment of people to one another, especially workers to supervisors, and also the adjustment of employees to company work requirements and job conditions.

In one of this country's largest manufacturing corporations the policy of hiring lawyers for their central or corporation staff is "balanced," as they speak of it, by promoting to that staff men with proven ability in handling men who also have experience and knowledge of the entire industrial process. Plant managers and executives who have had supervisory and plant experience, who know practical shop problems from actual contact and not theory, constitute at least half of the corporation labor-relations staff. At the plant level men are generally brought into the labor-relations department from successful foremanship or supervisory experience.

There is another pattern which is followed in the selection and grooming of men for labor relations in industry. A man with shop experience—sometimes a foreman, sometimes a time-study man, possibly a man in personnel—is dispatched on company time to study in a university selected courses in economics, sociology, and labor laws. The management men who favored this type of preparation for a career in labor relations did not feel that the types of courses in collective bargaining with which they were familiar were of any use to such a trainee; they were better calculated, they said, to help in the development and skill of union stewards. This opinion may be due to limited knowledge of the courses available.

Still another source of supply from which industry finds men to work their way up in the department of labor relations are the university students who have planned their courses to include all the academic preparation possible in the field of industrial relations. From this group men are selected who not only stand high in scholarship but who have shown personal traits such as emotional stability, persuasiveness, extrovert tendencies, and leadership.

One more estimate of what it takes to work in labor relations included a strong liking for those college men who had gained a broad experience in public relations—for example, as a newspaper reporter of varied contacts—and who then spent years working in the shop in industry, and also acquired specific knowledge of federal labor laws and the interpretations of the regulations of the National Labor Relations Board and the state labor department. Such a man, according to those industrial leaders who are frankly partial to this public-relations background, should be willing to study and keep up to date in economics and sociology and should have skill in handling human relations.

And now we come to a school of thought on this subject of what it takes in labor relations which reflects a counter movement to the present trend toward hiring more and more men with legal background. Incidentally, as we have shown in the sketches on specialists and personnel, industry finds legal training useful in many spots. In contrast to the industrialists who say that lawyers—whether or not they've passed their bar examinations—are trained in a habit of thought which is analytical, shrewd, and penetrating in interpreting laws and contracts (all of which, they say, is becoming increasingly essential to a labor-relations man), there are other educators and executives in industry who go so far as to deplore overemphasis on legal background for work in this field.

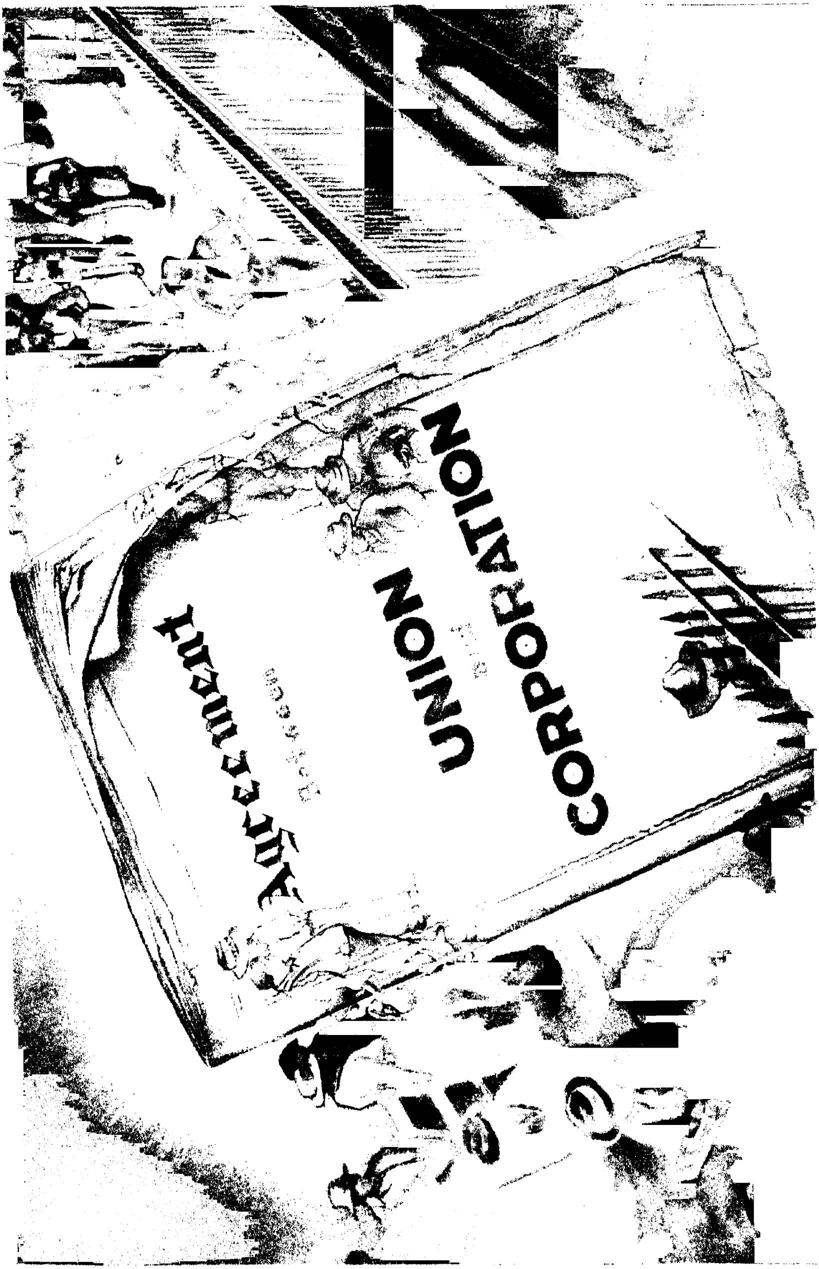
These particular men, some in academic halls and some right on the firing-line, believe in hiring consulting firms of lawyers to advise the director of labor relations, but they wish to head up *all* industrial relations under one coordinating leader. For this leader they want a man who works under a policy of promoting active management and labor cooperation in everything affecting employee and production policies with the exclusion of engineering, planning, scheduling, purchasing, letting subcontracts, decisions as to plant expansion, financial matters of all phases, and other policies which are purely managerial. Managerial policies are defined as those which have to do with the successful conduct of a competitive free enterprise but are not directly concerned with employee morale, welfare, security, and development.

The latter things, and all things which *are* concerned with industrial work in human relations, these believers in the co-operative approach wish to see under the leadership of a very special kind of man.

Without any bias on our part as to which of these opinions is the sanest and in the long run the wisest, we shall try to picture for you the kind of ideal industrial-relations man these would-be labor-management cooperators would like to see in control. And of course they would like to see him bringing up and grooming more men like himself.

They want the man to complete college, preferably in liberal arts, and then go into the plant of some industry for at least five years of varied experience; or they want him to start in industry as an apprentice and then, after five years, leave and go to college. In either case they want him to pick as his university the one having the most modern courses in all phases of industrial or human relations.

So far it seems as though the stress is on knowledge and



Agreement
between
UNION
and
CORPORATION

industrial experience. But that is not the main emphasis. The chief personal qualification is somewhat the same as it is for a top-notch worker in personnel, medicine, or industrial education, plus what we call a high type of sales ability. The man should have inborn talent in the art of human relations. He should have potential skill in cooperating with and also in leading people. And he should have the highest integrity as far as his genuineness and sincerity in *liking* to deal with human frailties, perversities, intangible virtues, and variable behaviorisms.

Beyond and even above such talent, he must be far above the average in mental health. "The mentally healthy person is successful in *altruistic* behavior more often than those who are less fortunate." And this means, we believe, that he must have such a spiritual slant as to make him feel a real joy whenever he can do some constructive thing for another person, without caring about either gratitude or a pat on the back from some superior, or even having anyone else know that he did it—the kind of joy that an artist feels when he creates a thing and knows it is well done.

That, in the books of these men who claim that such is the ideal man for labor relations, is really being "quite a guy," or, as that rare individual, the common-garden-variety, down-to-earth psychiatrist would put it, being pretty well "grown up." And that, these men tell us, is what it takes in labor relations.

It strikes us that there have been notable examples in our history of men who were like this in make-up and character and who also were lawyers—"all this and heaven too!" But the most notable of such men never worked in a shop. He did split rails. And he never went to college. But he studied by the light of a fire.

LABOR RELATIONS

HOW IT OPERATES

"Where there is no vision, the people cast off restraint:
But he that keepeth the law, happy is he."

"The prince that lacketh understanding is also a great oppressor:
But he that hateth covetousness shall prolong his days."

—PROVERBS.

Just as with engineering, we can only skim the surface of so vast a subject as industrial or labor relations. It is like a child standing on the shore of a great ocean when the sea is calm and skipping a flat stone out over the shallow water—he can neither reach far nor go deep. However, some of the essence of the problem is shown in the two equally true sayings we have just quoted. And they date back to the labor-management problems of the days of the Old Testament.

We live in a country founded for individual freedom. No one here, for the sake of providing more and more food, clothing, and shelter for every person alike, wants to give up our Bill of Rights. But we must reconcile decent means of steady safety as to living standards with the individual freedom of choice so dear to us all, workers and managers alike.

The better the management in industry, the better the labor relations. And most people like to think of labor relations as human relations. So also the better the human relations in industry the freer is the management to achieve success and progress. Banding together in labor unions, when wisely handled, is just as desirable as banding together in manufacturer or teacher or doctor organizations when these are wisely handled. Group aims, codes of ethics, and standards can be set. Craft guilds for old-time artisans served this purpose.

The problem of national legislation to insure responsible action for unions goes hand in hand with the problem of so governing the action of corporations that they too are responsible to the public interest. Balance as well as fairness in this making of laws is a prime essential.

But popular belief in any law is necessary to keep it in force. So we are still striving in this country, in contrast to the worked out, comparative stability of countries like Great Britain and Sweden, to come upon beliefs and practices right for democracies and right for our own concepts of liberty for both capital and labor.

These major issues affect today the way in which labor relations operates in industry in the United States. We have extremes of method, of course: small factory paternalism with a company union; reactionary management fighting collective bargaining; a complete sharing under a consumers' cooperative—one share of stock allowed to a customer, who benefits in profits according to the number of the company's products he buys; and other out-of-the-general-line procedures. They do not concern us here. Furthermore, no conclusions in labor relations can be drawn from a few isolated cases. For example, champions of the incentive plan of paying workers a basic minimum wage plus a bonus for each unit of production above a certain level, claim that the harmonious labor conditions in a special company are due to the incentive plan; therefore, they say, it should be a universal industrial practice. However, an investigation may show that the company has a patent for one small gadget, has a steady market which is not seasonal, all stock is owned by a few men who manage the company and who believe in exceptionally liberal wages and unusually pleasant working conditions; the few plants it owns are small and so long established that individual employees are not strangers; sons come into the plant to follow their fathers; moreover, the union leaders are honest, responsible men, friendly to the management whom they thoroughly trust. So who knows how much any *one* factor in this idyllic, isolated picture affects the harmonious whole?

One single panacea, with wholesale implications for big as well as little industry, would seem to be a matter of wishful thinking, a pipe dream. Solutions as to methods must be flexible and must be devised to meet particular situations.

For this write-up we cannot hope to tell of the working-out process by which the members of all the industries have settled upon procedures to carry on either circumscribed labor negotiation or the broader job of industrial relations. It is apparent that the system of collective bargaining is today a generally accepted procedure. This means that employees (mainly production workers below the rank of supervisor but also special groups such as technicians, office clerks, or in some cases foremen) have held an election and settled upon a certain union which they will join and support. They have also elected the officers—plant committeemen and stewards of the local branch of that union.

The corporation or central staff of the labor-relations department then meets with the union representative and negotiates or decides upon the detailed agreements in a contract, which is generally to hold for one year. If the contract calls for a closed shop, all employees of the company must join the union in order to hold their jobs. In an open shop an employee may or may not join the union.

The way in which grievances or complaints from employees are to be recorded is specified in the contract. Such an agreement has a clause specifying that the union will not call a strike until all proper appeal through the established grievance procedure has been followed—a vital part of a contract.

Contracts may also include specifications as to classification of workers, rates of pay, vacations, seniority rules affecting promotions and layoffs, disciplinary rules, and all matters of similar nature which affect labor-management relations.

Such a contract having been drawn up, it would seem that the negotiating or collective bargaining was finished for at least a year. However, there are no final answers in human relations. The interpretation of the contract in regard to a particular situation is sometimes open to argument. This must be settled by the union and the corporation representatives. Then there are specific grievances that arise where an employee feels that the company is not, in his case, sticking to a provision in the contract.

Different companies have different ways of trying to settle grievances. But in general the employee takes his complaint to the foreman or to the chief steward. If it is to the latter, the chief steward goes to the foreman and they attempt an adjustment or clarification of the point in question. If such adjustment is not made, the grievance is put in written form and submitted to the foreman and to one member of the union's plant committee; the plant committeeman also takes up the written grievance with the superintendent. If not then settled, it is referred to the entire plant committee, a copy of the grievance is sent to the labor-relations supervisor, and a meeting is held by him with the union committee. If still unsettled the grievance is submitted by the union to the plant manager; and if no agreement is reached it will go to the officers of the local union, who will again present it to the plant manager. Failing settlement, the local union prepares a written statement of "all facts and circumstances surrounding the grievances," and the plant manager also writes "a complete statement of the case." Copies are sent to the international union and to the director of labor relations of the corporation.

The director may send members of his staff to investigate the matter at its source and then attempt a settlement. If this procedure does not effect a settlement, the union sends all previously prepared written records of the case to the vice president in charge of operations, together with a notice that the decision of the director of labor relations is not satisfactory to the union. "The matter may then be submitted to the appeal board for final disposition, such disposition to be made within thirty days of the submission."

This appeal board consists of two executives of the corporation, two official representatives of the international union, and an impartial chairman. The company and union members attempt to settle all grievances referred; but if they do not, then the impartial chairman, not a majority of the board, makes the decision.

It is after a final decision is handed down by the appeal board or the impartial chairman that the union may feel justified in calling a strike. Of course such a strike shows that the union will not accept the decision, and it would seem that collective bargaining, properly carried out, is being flouted. However, the union often feels that it is striking because the national law itself needs to be changed in the interests of better working conditions.

The kind of strike that is called "wildcat" is one in which, at any stage of the proceedings, perhaps before the grievance has even reached the company's labor-relations director, certain members of the union walk out on an unauthorized strike—a strike not called by the officials of the union local and not approved by the national union officials. It is the prevalence of this type of strike which is often deplored equally by both labor and management. And strikes of this kind mean that the leaders in the union cannot be looked upon by management as having control of their members or responsibility in holding to their written agreements.

It is certainly not our purpose to write of the many present points of view prevailing in industry regarding union problems and labor negotiation. It is significant and hopeful that education is now being undertaken on a broad scale leading toward several desirable aims. Foremost among these aims are the prevention of the occurrence of grievances, as far as is humanly possible, by better selection and placement of both workers and supervisors; the attempt to set up plans for cooperation at the top, nationally and in each industry, as well as at the bottom in labor management; and the training and development of better understanding and healthier attitudes on the part of all management, supervisors especially, and all labor representatives, stewards especially. Such education to bring out the mutual aims and the mutual *stake* which labor and management have in industry may be eventually extended through public schools, as well as through industrial education to the rank and file of industrial workers and to the entire public.

The ground-swell movement all over the world to work toward peace through cooperative effort is being extended to emphasize justice. There is talk of an international bill of rights. All men of good will are heartened by these signs of the times this expression of ideal aims. Nations, corporations, unions may, like individuals, go through a kind of Gethsemane which will make them revaluate their actions, make sure that they have built upon a rock, and then set to work to put their houses in order. Thenceforth they can carry on with active faith, no matter what storms may beat around them.

SUGGESTED READING: "My Life in Industrial Relations," by Clarence J. Hicks, published by Harper & Brothers, New York. 1940.

Epilogue

MAKE UP YOUR OWN MIND

"Let the counsel of thine own heart stand, for there is no man more faithful unto thee than it. For a man's mind is sometime wont to tell him more than seven watchmen that sit above in a high tower."—Apocrypha: Ecclesiasticus.

IT IS well that you seek out the counsel of wise men, those who have been through the mill. But in the long run it is you who must decide and you who must do. Make up your own mind. And yet realize that in that mind of yours there must be change and growth. Expect to keep on growing up, growing wiser, in this matter of making choices and decisions about your career. And realize too that what happens throughout the whole world will find its way into the picture of your one life.

You must, in this age of flux, be so geared to change that you can shift like a pilot who, hearing a quick warning of hurricane or blizzard, changes his flight, picks up a new beam, and makes the field. Even if this pilot must take a different course or make a temporary landing, he'll make the field he headed for. Flexibility—shift of ways and methods—means no giving up of goals.

Ideal aims—loyalty, dependability, honor, keeping a good name, being a good public servant, being a good friend, raising a fine family, creating new knowledge, building better things—all men have these goals, few men talk of them. As to exactly what your own shall be, you must do some purely individual thinking. Values you must determine for yourself. And ideal aims need never change. They will be to you like the fixed North Star as you navigate your own small bark on stormy and uncertain seas.

But change of ideas you have always known and will know, we hope, as long as you continue to pass the time of life. Consider how many times you've already picked a career. At five you might have been a fireman. At ten you were sure to be an aviator. At fifteen you had to be a football coach. At twenty you were in the navy. At thirty where will you be?

Will you jump now at the chance to enter a premedic course because the government will pay for it and doctors earn big money? You may know yourself you were never meant to be a doctor. You don't really want to be a doctor. It's just that it seems like a good chance right at hand, and a friend of yours is starting. He tells you to come on—the university has a good football coach. You can both try out for the team, and you can drive down in his car to register. Come on and go!

Of course the very fact that you're looking into this book shows that you don't let another man do your thinking for you. You want information about industry. You may not feel sure that you want to be a part of so-called big industry, but you are investigating the subject. This gathering of facts is one of the essential steps before you make up your own mind.

You may be nearer sixteen than twenty-two and you want to know the kind of high-school courses to take to prepare you for the career of a skilled artisan, a toolmaker; or you may have just begun to realize that you should start now to plan your present courses as a foundation for college work which will lead you in the end to the career of an engineer. Then again you may be a man who is more mature and who wants to make a change in his work—perhaps a man who has come out of war service. As you plan a new career, you too are considering industry. You want to know more about it, and you want to know how to make a well-informed, intelligent choice.

You will be wise to secure facts about various business and professional openings. You must also get as many facts as possible about yourself. In this book you have read of what it takes to be a dieman, a time-study man, a labor-relations man, not only from the point of view of schooling but also from the point of view of personality, aptitude, and the kind of interests, leanings, or likings that are yours.

You will need to do some intelligent appraising of yourself as well as of the job or the career. The important thing is the right combination—the fact that you and the job are clicking. There are many ways of putting this. In the vernacular we used to say a man was "hitting on all six"; now we are likely to say he's "on the beam."

The experts in education talk of "an integrated personality." The experts in psychiatry call it "a unified person" and speak of such a person as making a good adjustment and having no conflicts within himself—no sense of frustration or fear or inadequacy or worry. Having emotional poise, being in good health mentally—these are the earmarks of a man who has what it takes. But, like life itself, these things are fluid. It is the maintaining of balance and poise *come what may* that counts—the faculty of not allowing the things that rock the boat to swamp it.

The present concentration on counseling, both in employment centers and in our schools, the emphasis on adult education, and the acceptance of cooperative education (half-time job experience and half-time school experience) are all attempts to help an individual plan intelligently his career or course of life. All of our consulting guidance experts feel that there is no substitute for actual experience. They say that helping him get a real job in the kind of work he believes he would like to do is the best way to help a person make up his own mind. There is nothing speculative about a job. A man with a job is up against reality.

Let us suppose he wants to be a machinist. If the drive toward mechanical things is strong enough, and especially if the mechanical aptitude or talent is really there so that satisfaction is found in doing the job, it is probable that the necessary self-discipline to accept the unpleasant, irksome side of the picture—the oil, the grease, the time clock, the straw boss, or whatever it is that seems like grief to him—will be developed. In the very act of staying with it, proving he can take it, the individual begins to grow up. And no amount of academic discussion of the pros and cons of certain kinds of work is equal to this learning-by-doing evaluation of a job.

We have considered the cooperation between schools and industry and the plans for cooperative education on the high-school, college, and adult level as being of such significance in the over-all problem of guidance that an entire chapter has been devoted to it. It is the succeeding chapter, and we refer you to it for a more detailed picture.

Now let us suppose that you cannot or do not choose cooperative work and study. What then can help you to a decision? Well, we believe that there is a way of using tests, interpreted by a counselor, to help you make up your own mind; not the counselor's mind or your parents' minds or a teacher's mind. And certainly not the impersonal mind that any paper-test results represent.

We suggest that you consider first what your own capacity, drive, and desire can tell you. If you are a person whose talents are so clearly marked that you know of one kind of work which for you "obliterates time," as Dean Schneider of Cincinnati used to put it, you will do well to consider that such work may quite likely be the foundation for your career.

Pick out then the general field of work you want. Find out what the qualifications are to enter specialized training in that field. Find out what personal abilities and attributes are needed for success. Talk with people who know you as to their opinion of your likelihood of succeeding in that particular field. See if your school record shows you have capability in the necessary groundwork subjects. For example, unless there are extenuating circumstances, in order to succeed as a commercial artist you should have good marks in drawing and subjects related to art; whereas to become a chemist you should deserve a good grade in chemistry. Your marks should indicate the general trend of your abilities.

As the next step, proceed to take a group of tests (the experts always speak of them as a "battery"—it sounds a little militant, but walk right up and face the guns!) selected by a counselor or by the testing expert on the staff of the board of education. The following list indicates the kinds or types of tests you might well take:

General intelligence test—Verbal; nonverbal. Be sure that you take both.
Achievement tests—Reading; English; mathematics; science; history; art.
Personality tests—Take several of different make-up or methods or approach.
Interest tests—Take several of different make-up.
Aptitude tests—Mechanical (written and performance); spatial relations; mathematics; clerical practice.

We believe that testing results—if the scores are interpreted in conjunction with a real conference between the one being tested and a personnel interviewer or counselor who has insight or intuition, also the art of drawing people out and the art of listening intelligently—will help you make up your own mind. Tests, while not infallible, are continually being improved. However, no one has found a way to predict adequately, through any personality or character test, the attitude and behavior of a person under a changing environment.

In other words you will grow up, emotionally and socially and in countless ways, and you will build for yourself those primary essentials for a good career—a fine character and true spiritual values. And how well you will build, no type of test can tell you. It is up to you.

Under general intelligence tests we suggested that you be sure to take both the verbal and the nonverbal. The present feeling among testing authorities is that there are more varieties of intelligence than of school brightness. Some people, as we all know, can be school-bright and life-dull. It has been the articulate student—the one with verbal intelligence who had good reading ability and did academic work well—who has always been Johnny-on-the-spot in recapitulating fast what he had got from books when the long examinations were given; therefore he was the top student.

In contrast to the verbal test, the nonverbal test aims at measuring your ability to think and perform in response to the spoken word or through the use of diagrams and pictures.

As an example of the necessity for both kinds of intelligence tests, and also in proof that tests can be valuable as one aid in self-appraisal, we cite this actual occurrence. Jones, a freshman in college, failed in several subjects and finally dropped out. However, he was bound and determined to be a mechanical engineer and he decided to try a testing program. He took verbal and nonverbal intelligence tests, and the results of the verbal test were discouraging. But the nonverbal test revealed a better than average ability to think and perform. Later, when Jones took the reading test, he was found to have a reading deficiency. This handicap had, of course, affected the results of the verbal intelligence test. He returned to college, took a lighter program of academic subjects, and was tutored in reading. At the last report Jones was functioning well since his understanding of the nature of his difficulties had led him to take corrective action.

Achievement tests will show you how you stand on information and knowledge as compared with thousands of other students of your age and training. You can see yourself against a background of these other people, and the person who interprets the tests to you will tell you where you particularly shine.

Personality tests will help you in chosing your career in so far, and only in so far, as they can help to high light your dominant characteristics. You have read in this book of the personal traits that are desirable for each kind of work, and the test results may cause you at least to do a little soul-searching to face the facts of whether you have or you have not what it takes. It is obvious that you will be wise to do all you can do to get facts from every written and spoken source to help you make up your own mind.

And then, when all the cards are down, decide. Don't make any more bones about it—just decide. Pick out for yourself the kind of career you intend to build and the first job you intend to get.

But remember the North Star. Hang on to your ideal aims. And no matter how rattlety-bang your little wagon looks to you, youth or adult, after all this personality probing and mental x-raying by the experts, be valiant, be adventurous; wheel out the poor old crate, climb in, and hitch your wagon to that one fixed star.

THE SCHOOLS AND INDUSTRY

JOSEPH PENNELL made a series of etchings called "The Wonder of Work," but even he couldn't picture the heart of the wonder of work. For the real heart is in the rhythm and the swing and the uplift of thousands of men pulling together toward a common end. It's pretty hard to put into words. It's a feeling you get when everything is timed right and production is humming and you're a part of a great thing and you lose yourself in the harmony of the whole.

You might go home and take off your shoes and shout to your wife to hurry up supper and say you're dead tired—"things are hot at the plant"—while thinking to yourself, "It's coming along, we had a good day." Or you might walk into your library and say to that part of your family you find there, "I'm sorry; you'll have to make excuses for me at the Bradfords'. I need a good night's sleep. Tell Huxley to call me at six. There's a big job on at the plant."

You feel it whether you sweep the floor or direct the works. Some call it teamwork; some call it cooperation. It is this spirit which far-sighted citizens of our nation wish to establish between schools and industry. It is this up-and-at-'em mutual fortitude which will build a better world.

Already all over our country both educators and business men—industrialists—have been meeting to set up a common goal and the sensible ways to shoot at that goal. But at one of these meetings a certain educator was what he loved to think of as a realist and a scientist and a fact finder. So he said, "Well, now, after all, what have industrialists in common with educators? You seek to make money. We seek to make men of culture and ideals. What common end have we?"

"The common end of mutual survival," said an equally blunt industrialist. "To keep all your schools running, public or private, you need the money we make. To keep us running we need a generation of young people with sound and honest and reflective ideas—reflective of the principles of freedom in competitive enterprise. Collective chaos was the answer to the schools of Germany. We need to cooperate—God knows we need it. We can truly say we must have it for the sake of national survival, for our country grows more and more industrialized."

And that is the main issue in the long-term wisdom of cooperation between schools and industry as we see it.

It would be a good thing for the whole community to adopt the ideas of Charles Kettering of General Motors and open the excellent resources of the factories and the laboratories of industry to special students from high schools and colleges. Young people in the old days learned from their elders while working with their hands. Mr. Kettering, writing in the *Antioch Notes*, says, "I believe in the future that all forms of education will have to take on some sort of cooperative relationship with industry. Our experience with war training has taught us that. This does not necessarily mean that the student would have to spend half of the time in school and the other half in industry. I am thinking in a broader sense. I am referring to any system that would tie together the educational institutions and the industries or other everyday affairs of the community, so that the schools do not have a perspective in one direction and the industry or community in the other."

And now we come to a consideration of one particular system of cooperative education, the half-time-in-school-and-half-time-in-industry plan, which hopes to do some good in the scheme of things. This plan was started in 1906 at the University of Cincinnati by Dean Hermann Schneider, a great engineer, educator, and philosopher, a man of vision and wisdom. We shall examine the general idea and report it as a neutral might do. (Frankly, we like it when it is applied to the right students and thoroughly worked out in the right way. It is of no use otherwise.)

The public high schools in many of our largest cities, beginning with Boston, inaugurated many years ago a plan by which high-school students in mechanics arts gained actual experience in toolrooms and machine shops. And before that, in European countries, the idea of combining book learning, or theory, with practice was always a factor in the excellent training of artisans.

One of the latest methods of working out this high-school cooperative plan in the trade schools of a city and also in some traditional high schools, is to select groups of students, mechanically inclined, at the end of the tenth grade, and alternate the experience of the last two years of high school between the school and the technical-training division of industry.

While one group spends two weeks studying traditional subjects in schools, the other group is learning by doing—operating, repairing, and studying machines, amplified by visual aids and classes in shop theory and shop mathematics, in one of the plants of industry. A standard training-rate of pay is earned by the student while in the plant.

At the end of the two-week period the groups change places. The students continue the program through summer school and are graduated from high school after two years.

They then complete their apprenticeship in industry with another two years of training, at which time they are required to attend classes—totaling 384 hours in a year—given in the public schools. These classes are selected to supplement and make more meaningful their work experience. Classes in social and economic problems and employer-employee relations as well as classes in hydraulics and drafting indicate the type of program.

The corporation sponsoring this plan also has initiated cooperative programs in business training and in applied arts—home economics and commercial art—on the high-school level. In the agreement drawn up with the school authorities there is the following statement regarding the industrial office training: "Office training shall be provided in amounts determined by the coordinator and the corporation."

Factory cafeterias and executive dining rooms serve as laboratories for the industrial experience of girls in home economics, who learn from experts about the buying as well as the preparation and service of food. The students of commercial art, working under experienced designers, gain experience in designing visual aids for use in the technical-training division.

It is obvious that the total economic and employment picture in the next few years will influence the extent to which industry will enter into the high-school cooperative movement.

In 1943 Chrysler Corporation, working with a few Midwestern universities, pioneered a program to give teachers a chance to work throughout the summer in the technical-training division of the company. The teachers spent eight hours per week in the plant, having classes and lectures. Forty hours per week were spent operating a variety of machines. Half of the classwork had to do with counseling and guidance presented by school specialists. The other half included talks on industry given by the corporation executives. Four semester hours of graduate credit, in addition to their hourly wages, were earned by the teachers and administrators who, men and women, put on working clothes and turned out production.

The next summer the Ford Motor Company and several large department stores in Detroit took up this work-study plan for teachers. The idea also spread to other states. It is a unique type of cooperation which should lead to a more realistic understanding of the present-day methods, achievements, and aims of both educators and industrialists.

In writing of the college-cooperative movement in engineering, commerce, and the applied arts as started by Dean Schneider, we shall take it up from the idea of benefit to the student, to the college, and to industry. Then we shall frankly discuss why it is hard to work out.

First, for the student. It helps him find out if he's headed toward work where his talents lie. It helps him adjust to life in the working world, to find out how to cooperate with all kinds and conditions of men. It helps him plan ahead, to know in what field to specialize. It helps him earn money which will assist him in getting an education. It helps him gain ideas of different companies' policies and ways.

Since a job in itself is a great teacher, it helps him check his theory with actual practice, to understand how to apply book knowledge. It helps to interest him in practical problems, and makes him see why he needs to know the fundamentals in his profession. It helps him later on, if he should become an executive, to understand the day-by-day working problems and feelings of people under him, from remembered experience. It helps in many practical, specific ways; for example, if he becomes a designer, he can more readily visualize the machining process after having worked in the shop. It helps him get a better coordinated picture of the industrial setup, to see how engineering, production, finance, and sales must work hand in hand. And it helps him tremendously to make the difficult transition from the sheltered college campus to the highly responsible, highly competitive, high-powered and high-strung world of trade and industry.

Next, the benefit to the college or university. His work experience helps to send back to the university, to the college classroom, the best of the latest methods and experiments from the firing line in industry. It helps motivate the student to see that know-why as well as know-how is important. He sees on the job a craftsman, perhaps more highly skilled than he'll ever become, who can follow but couldn't *draw up* a blueprint. It helps the university to have a youth return to his studies well aware that he must learn the fundamentals in his chosen profession of engineering and architecture, or of economics and accounting. His work may well produce that felt need in the student so helpful to the teacher in *timing* the presentation of academic subject matter so that it has life and meaning.

Cooperative education has a practical economic advantage to a school inasmuch as the faculty can care for nearly twice the usual number of students in proportion to its building, laboratory, and classroom equipment.

But the main help to a university ties in with the value to the student along the line of intelligent guidance. Through observation of the changes in a student, as well as the reports of the coordinators for both industry and the university, plus a skillful drawing out of his reactions to his work experience—feelings as well as facts—a teacher or counselor may be helped in guiding the student's future experiences.

For example, he must know when to simply steady a lad who is disappointed, who feels disillusioned and hopeless on a job—as the dean of one university put it, "a fellow who's so badly bowled over he even cries in dismay at the real world he's found." It may be years before that immature, impatient idealist can look back and see for himself that he was learning the most at the very time he wanted most to give up. Quite likely he can recall, as a much older man, the very detail of how he first learned in the school of hard knocks the patience, courage, and tolerance to live with imperfections—in people and in situations; the balance to accept compromises and half-way measures for a time and not be embittered or floored by them. And he may well remember how he was wisely led by his university advisers to stay with an unhappy, even unjust state of affairs in his work until he'd mastered the art of giving in gracefully and generously to the ways of others while holding undaunted to his own ideals.

The cooperative system also helps a university to put one of these tender young plants in the right soil for growth and yet be on hand to give some water should it wilt; or to transplant it entirely if the glare of the sun or the fury of the elements is too much for it. It helps the university to help a student learn through his failures, perhaps to discover what he *can* do, and where his bent lies by finding out what he *can't* do. In short, it helps the university in the little understood, greatly involved, but vital job of vocational guidance.

Finally, for the benefit to industry. A living organism—a big enterprise—must renew itself, reproduce new life, just as the body grows new cells. The cooperative system helps industry in its long-term training program. Replacements must be slowly and steadily coming along for the natural turnover in skilled master mechanics, paperwork men of all top classes, supervisors, and junior executives. The gradual orientation under the cooperative system helps to shorten the usual breaking-in process after college graduation. This breaking-in process takes place with less wear and tear on the one in industry who must effect it. It has too often taken a couple of years to bring the usual graduate theorist down to practical reality. "Coming down to earth" involves accepting routines, delays, frustrations, and drudgery such as are found in any job. It includes understanding many people who are safely holding to dogmatic, traditional ways, and their occasional resentment toward a new associate with more book knowledge and less experience than they have. And it includes, for a newcomer, developing the adaptability and proper sense of humility and proportion necessary for getting on well with many personalities. All this comes about more quickly and with less grief with cooperative students.

The system helps industry in getting into contact with prospective employees, so that the hiring and proper placement of them is less of a gamble. Industry can know whom it wants and have more of an idea of what it is getting. And as a last point, cooperative education also helps to stimulate old employees, through their association with the university students, to keep up to date on recent theories, trends, and discoveries in their technical fields.

Now why is it hard to make cooperative education work? Well, there are certain difficulties. But no good thing comes easily. And some people say that nothing is too hard that we do willingly. It is, of course, easier to regiment than to individualize; so it is simpler to organize a school administration without special groups or teachers or the changing of students from one course to another.

It is easier for industry to keep on calling to the universities for graduates with perfect attitudes toward their jobs—readiness to start to learn, no feeling of college-degree superiority over men often better educated but without equal school background. It is easier for industry to simply say to the universities, "We want graduates who know how to *do* things, who can take orders and follow through, who are all set to work and learn" than it is for them to spend time with cooperative students, doing some of this grooming and setting up of good learning situations so that when a student is graduated he'll more nearly approach the kind of worker they want.

Also industry wants the same steady quality in performance on a job; if one co-op does his work well but when he goes back to school the same work is too much for his partner, an adjustment of the job has to be made or a part-time helper put on; and this takes time and patience from the one in charge—it's annoying.

Fellow workers may resent co-ops, as they think they are going to be headed up the ladder and consequently are given preferential attention; therefore these older workers feel frustrated, even though they have reached their own highest capacities. Sometimes they resent seeing "a mere kid" working along with them when it has taken them ten years to advance to that kind of work.

Industry—a corporation—has to spend time and thought and effort to explain throughout a plant, from the top down, the necessity for joining forces with cooperative students all along the line in order that the company may select from among them higher types of skilled employees whose knowledge and background will, in the long run, make the success of the business more assured. Industry also has to be willing to open the door of opportunity, through college-cooperative training, to any one of its old employees who asks for the chance to enter such a course and who can prove he is qualified to undertake it. "Upsetting" one department by transferring a worker out of it should not be allowed to keep a man from opportunity for advancement. Such an ambitious employee must accept a certain cutback in yearly income and an uncertainty as to placement on a job in the future. He will leave comparative safety for the adventure of preparing himself for a possibly better future; it should be *his* gamble, his decision, not the company's.

As to the student, he will often find it easier to put off the evil day when he must leave the more sheltered college campus to try to fill a job.

If he lacks drive and vision and a desire to grow up while he is still a student, he may want to "go it while he's young" from a purely pleasure-loving angle, and feel that he's not geared for the more strenuous cooperative program. Actually, however, many of the campus leaders in sports and student activities are the up-and-coming engineering co-ops.

If a student must have an ivory-tower existence or feels that he can't battle his way and adjust to competitive industry, he shouldn't attempt the program.

If his talents are marked in some creative or pure-research line, he might learn more and do more good in the world by steering clear of the drain on his nervous energy that the monotony and detail and conformity of mass work in some parts of a factory will involve. Cooperative education is no formula to be followed blindly by all alike. A wise school authority sifts out those for whom it is not indicated.

As Mr. Kettering has summed it up, it is a method of "lap-welding" rather than "butt-welding" technical training and professional activity. None of the academic background is sacrificed, but standard practice is dovetailed with industrial experience.

In most of the university schools of engineering the student does not begin on industrial-job placements until his second and sometimes his third year; and five complete years are required to earn the bachelor's degree. The period of time spent in either the university or the plant before the study group changes places with the work group differs widely—from one month to a full semester—in the various universities having cooperative programs.

The system also serves a practical purpose in individual placement following college graduation. We shall surely know much more about growing, changing, versatile, human beings in the years to come. Research men in medicine and science, particularly endocrinologists, psychiatrists and chemists, are continually learning facts about heredity, emotional tone, and nutrition, as well as many other facts that explain why we are the way we are. Some day we may not need to

follow, in vocational guidance, some of the cut-and-try methods which now serve a useful purpose under the cooperative system of education. But even if more valid ways could be found by scientists so that we might put a man under a laboratory machine that would test and try him as a spectograph now measures the make-up of a piece of metal, we should still find the "ornery" human animal just won't stay put at any one stage of the game.

Especially will the thoughts and dreams, the moods and ideals, of adolescents refuse to stay cast in any mould. Thus it was that the very wise Dean Schneider worked for forty years—an iconoclast and a builder of new ways in education—at his task of unearthing those still unrevealed talents that might, through trial and experience, be brought to light for a groping youth and lead him to his right work and to a fuller happiness on this earth.

SUGGESTED READING: "Ambassador to Industry," by Clyde W. Park, published by the Bobbs-Merrill Co., New York. 1943.

ABOUT THE FUTURE

NO CRYSTAL balls to help us, nor tea leaves—not even the stars; and yet we venture some guesses, some thoughts, at least, of things to come. Industry is full of thoughts of the future—in the minds of its managers, its engineers, and many of its rank-and-file employees. New products, new methods, and new markets are continually being studied. And ideas about human relations are also the subject of research. In the competitive world of big industry, most of the new inventions and engineering developments with which the dreamers and designers experiment are known to very few. They are the carefully guarded state secrets of industry—carefully guarded until tried and proven and sprung on the public in advance of a competitor.

Rumors are rife today of new ways to build things and new living-comforts. We hear rumors about mass production of prefabricated houses and about the foolproof skycar which will carry us on the ground and in the air. Perhaps someday some as yet unborn engineer, inspired by the ways of a crane, a fish hawk, or a sea gull, will add to the skycar a pair of folding pontoons, whereupon the export man for Chrysler or General Electric can steal a few hours of his regular trip to Cuba for a bit of deep-sea fishing!

The temptation is there, as you can see, for us to give free rein to a sort of Mother Shipton's imagination and dream of a hundred years from now. However, we have picked for this section only two examples of new ventures. One of them has been experimented with for many years. The other, we think, is a new tool with which we might well begin to experiment. Neither one has been worked out in full detail, so that there is a certain element of guessing ahead as to the extent of industrial usefulness in the near or far-off future.

The first venture, Cycleweld, has to do with material engineering; the second, the Educational Council in Industrial Relations, has to do with human engineering.

The following digest relative to Cycleweld was written by a young engineer, an architect, who typifies to us the coming generation of contributors to industry. He has a clear-eyed freshness of approach to industry, a faith in the soundness and usefulness of the work he is doing, and, above all, an imaginative enthusiasm and optimism about the new world that young people are going to build. He makes us feel that these practical young idealists will not only drive themselves hard to build but will enjoy the whole business of life—leisure and culture as well as the building of products—and will savour and appreciate each experience in this creative, growing era as they make their marks on it and it, too, marks them.

CYCLEWELD

"A glue that could be used to join all materials, particularly metals, and join them more strongly than they could be by bolts or screws or rivets, was a problem long unsolved by inventors. Cycleweld, at last a solution, is a process based on the plastic weld and bond made by Cycleweld cements and the application of moderate heat and pressure.

"The whole backlog of things that the inventors wanted to do if they only had such a glue can now be done. Houses, airplanes, automobiles, refrigerators, and furniture are among the almost unlimited list of adaptations. What is more, the structures of today depend for their construction and shape on the fabrication methods of today, the nuts and bolts and screws and rivets. Structures designed with these joining methods in mind cannot be fabricated by simply substituting the Cycleweld technique. The automobile or airplane has to be reengineered to take full advantage of this strength, lightness, and clean structure made possible by Cycleweld. A new vocabulary of ways to put things together has to be worked out. And not only the vocabulary but the words—the cements and materials themselves—have to be developed.

"Much of this work has been and is being done. Actually a peacetime development, Cycleweld contributed appreciably to the war effort of the United States and its allies. To carry this work into the expanded fields which the postwar era brings, many men and women with different backgrounds will be needed.

"Engineers, architects, product and tool designers, chemists, model builders and those interested in development, business, sales, production, supervision, and actually producing, will all have a contribution to make. Each must have a good general background plus the training that goes with his or her special field. In addition, all employed in the Cycleweld activities must receive training in the basic techiques of Cycleweld processes. Each then has the opportunty to use his training, ingenuity, and resourcefulness to develop the cements and methods of using these cements, the words and vocabulary of a new method of putting together the automobiles, airplanes, and houses of tomorrow."

EDUCATIONAL COUNCIL IN INDUSTRIAL RELATIONS

The following plan is proposed by us as one method that may be used in the future. We venture to suggest a definite mechanism for handling further education in industrial relations, since so many industrial leaders with whom we have talked have voiced a need for some sort of trial machinery to use in human engineering.

All of them have said that the need to achieve intelligent cooperation—understanding and harmony—is critical. However, in the field of human relations in industry they all agree that they haven't the answers as to how to go about it. We too are well aware that we have no real answers. But we feel that the more permanent designs, blueprints, and operation sheets for a gradual, steady building up of a moral concept that will result in intelligent, decent behavior on the part of all concerned in an industrial enterprise, can best be decided upon after some sort of trial machinery has been set up and put to a test.

Theorizing for years, arguing among all the self-named experts, results in nothing but a stalemate. So here is a concrete idea. It does not exist anywhere in industry so far as we know. Perhaps some of you who are more venturous will have a try at it in the future.

HOW IT OPERATES

An educational council in industrial relations is a plant group, including representatives of employees and management, led by a neutral moderator. The moderator is appointed by mutual agreement of the company and the union. The cost of his salary is evenly divided between them. Although his usefulness to a company and all its workers grows in proportion to his experience in industry, he is selected primarily for the sanity of his outlook, his character, and his leadership in providing adult educational programs. He should also have shown ability in putting over publicity campaigns in a popular way. He must know how to use radio, moving pictures, and open-forum, "town-meeting" ways of educating instead of the academic, textbook, less palatable approach.

With the approval and sponsorship of the council he arranges a variety of informational lectures and open-forum debates given by well-known authorities who are also dynamic public speakers. A small admission fee and the free use of community auditoriums covers the expense involved.

Day programs for night-shift workers are arranged. These programs provide an opportunity for all employees of a plant to hear the best opinion on a variety of present-day questions, especially problems concerning industry, labor, free enterprise, and government functions.

So far the work of an educational council might seem to be a community cultural-development program already sufficiently covered by various groups throughout the country. This would be a misconception. The council aids and abets, through publicity, all the good-citizenship movements in its town or city and puts on cultural programs of its own; but its main job is to handle education for management, foremen, office and shop workers on definite plant problems.

Along with many personal "well-being" problems, which are being increasingly well handled by the counselors and all others in the personnel and medical divisions of progressive companies, there is another basic human problem in industry. That problem involves an understanding of the rightful functions and the rightful responsibilities of both management and labor. It also includes a study of their interdependence and the most sensible means to achieve their mutual success. And that problem needs a fearless, honest, practical, and fruitful kind of education for all concerned.

Without in any way settling administrative or labor negotiation questions, acting, indeed, with *no authority to decide on anything* of any kind in the plant, the educational council tries to get facts about these responsibility questions, and about all issues involving human relations, out in the open before all the groups who operate the plant—plain facts about specific, even controversial issues. It is the duty of the different factions on the council to present before the entire group all sides of any question. Then it is the duty of the moderator to bring out the facts on which all agree, list them, and add to them the quoted statements of representatives whose ideas differ. The kind of publicity given to the particular problem is up to the good judgment of the moderator, subject to the approval of top management and top union officials.

Let us consider one simple example of the working out of this industrial-relations educational plan. At the weekly meeting of the council the question is proposed, by either a management or a union representative, of trying out the effect on production of allowing lunch wagons carrying sweet chocolate, coffee, and ice cream to be wheeled through the shop in the middle of the afternoon and permitting a five-or-ten-minute "break" at which time workers may purchase this refreshment and eat it at their jobs. After each member's opinion of the merit of the plan has been expressed, it is up to the moderator to gather facts from other companies' experience and see if there is any evidence to support the contention that production is actually improved by this loss of working time.

At the next meeting—after the moderator's report—the question of asking management to try such a plan is voted upon. If favored, it becomes the job of the moderator to go to the general manager, without whose approval he can never take any kind of action. If the general manager agrees that the plan shall be introduced and the results checked, it is then up to the moderator to get the council to decide what kind of education should initiate this trial plan.

Talks over a broadcasting system at the lunch hour, made by both union and management speakers, might be decided upon and approved by the general manager. The *tone* of these talks is very important. With the right previous education and morale in the plant, every worker would be aware of his responsibility in not taking advantage of the break in working time as an excuse for prolonged loafing or lowered production. He would know that he was going to benefit in the long run if the brief letdown of nervous tension and the renewed energy from the sugar or glucose in his system made him improve his output.

But he wouldn't, if the council did its work well, think in some childish way that he was being bribed to drive himself to more work. He would understand that his efficiency was a factor in the success of the whole plant enterprise—that every time he shirked he was cutting off his nose to spite his face, for the company might have less chance to avoid layoffs and be less able to support a high and steady level of wages.

Another more general example of a problem which might be effectively handled by the council is initiated by the following statement from a company official.

"It is very important, at this time and under present operating conditions, that every supervisor take immediate steps to correct any misconception or misunderstanding of the basic business principles that value for value must always be exchanged between employer and employee.

"The standard production, as determined by past experience and studies, determines the minimum quantities that represent an hour's work. In order to arrive at an average daily production of parts, it is obviously necessary to produce more parts some days than others. Because of inevitable variations regarding stock, tools, equipment, absentees, and many other factors, no one should expect to produce an exact number of units every working day.

"Some employees and supervisors have lost sight of the principle that equivalent value must be received for the wages paid; that a fair day's work means the effort to work efficiently throughout the full day for which the corporation pays."

If the educational council was able to promote small group discussions of this fundamental economic principle of value for value, it might well lead to a better understanding of the whole subject of time study.

A strike which involved all the production workers in a large plant was based on lack of knowledge as to what constituted standard production on a certain job. The neutral arbiter who studied the question, to get the strike settled, ruled that the company requirement was even lower than the proper standard. Rank-and-file employees were justly critical of union officials who allowed a strike to be called when the company's time study had established a more than reasonable standard.

A wider knowledge of the "why" of value for value between employer and employee might have meant that more employees would have asked for the facts, and not prejudiced opinion, before walking out on a strike. If union leaders were not sincere and used the trumped-up statement that certain operators were driven too hard and their production was too high in order to foment needless hatred and bitterness against a company, the council would bring to light the true causes of plant dissensions and discontent. The *truth*, let the chips fall where they may, is the motto of an unbiased moderator. He can never be known as either a "company man" or a "union man," and he can never allow himself to be either propagandized or browbeaten by anyone.

The build-up of trust in the reliability of information given out by the council is dependent on the caliber of men who make up the group. The group learns by doing, and it is an education in itself to serve with it. It acts as a revolving group, shifting at least two members every twelve months. However, much of the effectiveness of the work of the council depends on the man picked as a moderator.

And that poses a question we ask time and again in this book on careers: What does it take? What does it take for a man to become a moderator for an educational council?

Thomas Edison said that genius is to be applied in this century to human engineering—"humanics" is the new word. Perhaps you yourself have some small measure of that kind of creative genius. If so, the chances are that whatever job you have, wherever you have it, you'll use your talent. Problems of humanics are older than written records of the history of man. Because of progress in material engineering and in collectivism for the purpose of spreading material means for securing food, clothing, and shelter, there is some danger that enthusiasts for systems in humanics will forget the all-essential freedom of an individual's soul.

If you have what it takes to work in industry or out of industry for the well-being of man, you'll see that he gets a chance to earn his bread and that he has—as far as can be—freedom from fear of want; but knowing that he doesn't live by bread alone, you'll not expect Utopias through a standard-job analysis or a well-drawn-up union contract. You'll recognize that labor is not a commodity, like steel; that men are not machines, but emotional, faulty, yet, in the main, well-meaning human creatures.

Working, wherever you are, in such a spirit of realism and in true unselfishness of purpose, the day may yet come in your career when your record as a leader and a creator of reason and harmony so speaks for you to the heads of a company and to the heads of a union that they both dig deep down in their pockets and collaborate through their dollars and cents; but even greater honor than that, they may collaborate in mutual respect and faith to name you as the moderator of an educational council.

When such a day does come, it will be in your hands from then on to sow so well the seeds of trust and wisdom and good will in the men around you that they will finally bear fruit in that time of which we write—the future.

SUGGESTED READING: "What's Past Is Prologue," by Mary Barnett Gilson, published by Harper & Brothers, New York. 1940.

THE ENDING

THERE are more things in heaven and earth than this world dreams of. It is possible that there is a law of nature, unnamed by man, which explains our strange ability to "rise to an emergency." In the field of medicine we know a little—only a little as yet—about this kind of response: the adrenal glands secrete adrenalin in strangely sudden fashion when fear and anger and the need-to-attack demand increased energy.

Can it be that such emergencies as war—the fear and anger and the need-to-attack of a nation after a Dunkirk, Stalingrad, or Pearl Harbor—call forth increased ability to think and to create? Creative energy, latent inventive capacity, abounded under the stress and need of a second world war. New means to save life kept pace with new means to destroy it. Sociologists tell us that there is a "cultural lag" after each new invention. Society is slow to develop the new tool. But in the emergency of war there was no lag. The B-26 was scarcely acclaimed in action before the B-29 reached Tokyo. A mechanized war is "right up our alley," exuberant Americans exclaimed.

It is true that the executives, the men of action, the engineers, the designers, the paper-work men, the tool and die-men, the patternmakers, the skilled machinists, and all the army of shopmen astonished the world. Especially in Detroit, among that great team which the Automotive Council drew together, there was no lag, inventive or cultural. Yankee ingenuity and the know-how of mass production, the system of making interchangeable parts, rose to an emergency.

But isn't that the way men have been operating, individually and collectively, since all record of human life on this planet? We have various ways of recognizing this apparent law of compensation, as Emerson called it. They range from the writings of the Greek philosophers and the Oriental sages to such jingling homilies as:

"Be strong! We are not here to shirk, to dream, to drift,
We have hard work to do and loads to lift;
Shun not the struggle; face it; 'tis God's gift."

And in quite a different vein there are some of us who, prodded by the stab of circumstance, gird up our loins, so to speak, and, grinning a bit ruefully, we say, "Needs must when the devil drives."

Then there are those of us who are perhaps old-fashioned. We know full well that a hundred years from now the combined research of anthropologists, sociologists, philosophers, endocrinologists, and psychiatrists, plus the work of physicists, chemists, and all pure and applied scientists in their laboratories, will have enlightened us far beyond our present ken as to the nature of man and his universe. But for our here-at-hand working world we cling to a few fundamentals that held good for the men who pioneered in democracy. We go back to the simple ways that held good for men as far apart in time and place as Socrates and Abraham Lincoln. We go back to the faith of our pioneer fathers. And we say to anyone, to any young man or young woman in search of a career, there is an undefined law of compensation, akin to the law of growth or the law of evolution; recognize it and abide by it. Walt Whitman had something like this in mind, we think, when he wrote, "It is provided in the very essence of things that from every fruition of success shall come forth something to make a greater struggle necessary."

Mme Chiang Kai-shek was referring to some such idea in a talk with President Roosevelt, for she spoke quite seriously, in reply to the President's hope that with God's help China would survive, when she said, "But God helps those who help themselves."

We are in a world that operates by law; we know next to nothing about the nature and extent of that law; we have merely picked so far at the fringes of the whole tapestry of life. We can't truly explain even one blade of grass. Yet that strange faculty we possess called insight or intuition tells us that we have within us unguessed possibilities. Great times make great men, we say, and hard times have often made fine men. In compensation for this trial by fire of the present generation, we are counting on the birth and rebirth of many men's souls. From somewhere must come the creative energy to meet the new emergency that is immediately at hand—the need to rebuild our systems of education, our world-wide social plans and laws; and the need, especially, to rebuild men and women—not only returned soldiers but all of us. This is a need to teach self-knowledge, self-therapy, and a sense of values. Beyond that it is a need to teach understanding of others, to teach tolerance and good will. And still beyond that it is a need to breed faith in men's souls that will carry them over all obstacles, to put into life and action and deeds the good that they know.

Human engineering all over this world will go forward, aided and abetted by scientific, material engineering, provided that our youth gets full opportunity and recognition in the years to come, that our mature men do not grow tired and slump into the old laissez faire, and that our wise old men continue to be of a pattern with that "great dissenter," Justice Oliver Wendell Holmes. These were Holmes's own words that the minister was reading just before taps sounded in Arlington Cemetery, and all his life, as the nation well knew, he had lived by these words: "We accept as our destiny to work, to fight, to die, for ideal aims. At the grave of a hero who has done these things we end not with sorrow at the inevitable loss but with the contagion of his courage; and with a kind of desperate joy we go back to the fight."